McGraw-Hill Publishing Company, Inc. OCTOBER, 1932 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine

A NEW WORLD'S SPEED RECORD FOR LAND PLANES

was established when Major James H. Doolittle, winner of the 1932 Thompson Trophy Race, exceeded 296 M. P. H. in his Gee Bee Super Sportster . . . POWERED WITH A WASP

AVIATION

Est. 1913 | McGraw-Hill Publishing Company Inc.

The Oldest American Aeronautical Magazine

EDWARD P. WARNER, *Editor*

LOUIS F. STOLL, *Publishing Director*

Contents for October, 1932

Volume 31, Number 10

Published monthly. United States and Mexico, $3.00. Canada (including Canadian duty) $3.50. Central and South America $3.00 a year. All other countries $3.00 a year, U. S. currency or 12 shillings. 35 cents a copy. Entered as second class matter July 27, 1933, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

McGraw-Hill Publishing Company, Inc., 330 West 42d St., New York, N. Y.

Cable Address—MCGRAWHILL, N. Y.

520 North Michigan Avenue, CHICAGO
Aldwych House, Aldwych, LONDON, W. C. 2
883 Mission Street, SAN FRANCISCO

For Dependability use a WILLARD

Whether the battery you need is for starting, landing lights, radio or emergency current of any kind, by all means specify a Willard. It means confidence—genuine satisfaction. Because it's not an ordinary storage battery—but a Willard. And that's a big difference.

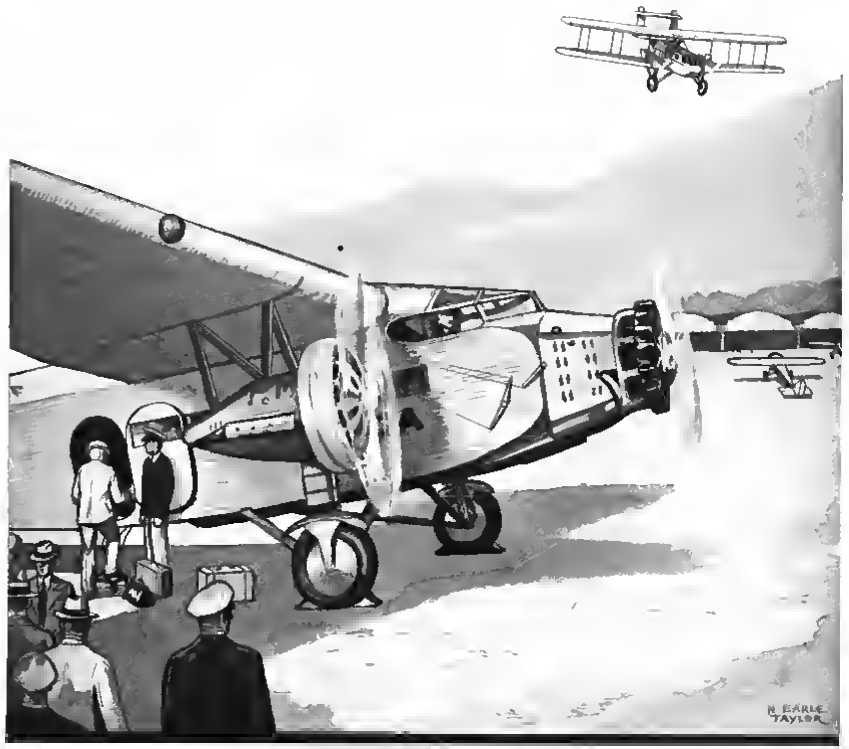
Willard builds a line of "Non-Spill" aircraft batteries at a wide range in price, including those with Thread-Rubber Insulation, an exclusive Willard product.

WILLARD STORAGE BATTERY CO.

Willard STORAGE BATTERIES

Cleveland
Los Angeles
Toronto, Ont.

PLAYING A KEY PART IN THE OPERATIONS OF PRACTICALLY ALL WELL KNOWN TRANSPORT COMPANIES



WYMAN-GORDON

GUARANTEED FORGINGS

On the Airways today as on the Highways for the last thirty years

WORCESTER, MASS. *and* HARVEY, ILL.

AVIATION
FOR OCTOBER, 1932

The record of the races

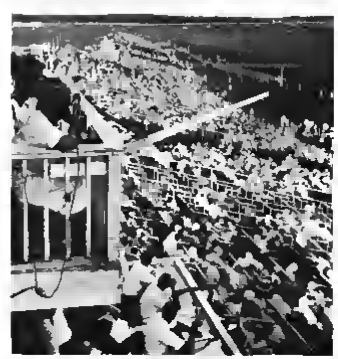
Who won what, and how

THE National Air Races of 1932 had better competition than ever before, and more special ships built for racing purposes. The program and the general arrangements were superior to those of any previous year. Most of the records of previous years were broken, and two world's records were established.

There has been a steady tendency to simplification. The distinction that used to be made between open planes and closed planes has been abandoned. So, with a few exceptions, has the distinction between men and women pilots. Something more than twenty events remain but most of the interest, especially for the aircraft industry, is concentrated on the nine free-for-alls, seven of them limited to engines of various displacements, the remaining two being unlimited speed contests for men and for women respectively.

Ten planes qualified to start in the Thompson race but only eight actually did so. Ben Howard withdrew the slower of his two ships, and the Menasco-engined Israel Special also remained on the ground. Something of the competitive uncertainty, of course, disappears from the event with the introduction of the straightaway qualifying trials, for the presumption is that the machine making the best speed on the straightaway will also make the best time around the course, barring mechanical trouble. It actually happened this year that the first six planes finished in the Thompson in exactly the order of speeds that they had recorded in the preliminary trials.

At the end of the first lap it was already apparent that Doolittle in the Wasp-engined Gee Bee was a sure winner if he could hold the pace that he had established. A long trail of black smoke behind the plane occasioned some anxiety but it got no worse as the race proceeded and the stubby Gee Bee, the pilot seated virtually in the tail, continued to circle the course at almost constant speed.



Aviation

The grandstand at Cleveland

The real thrill of the race, for those who were keeping track of the lap times, was the contest among the three Wedell-Williams planes for the next three places. The race was a Pratt & Whitney holiday, with Wasp and Wasp Junior engines occupying the first six places.

As might have been anticipated from the racing experience that almost all of them had had, all the pilots flew with great accuracy and gaged their courses to cut the pylons very closely and to make their turns so that the pylons would be located just about at the central point, instead of starting the turn when abreast of the pylons as those without pylon experience are prone to do. There was a wide difference between them, however, in the steepness of bank and the shortness of the turns attempted. As bearing on the interminable discussion of the most efficient method of making a racing turn it was noteworthy that the first three places went to the pilots who turned with the smallest bank and on the widest radius but the fact was scarcely conclusive for Haizlip's defeat by the other two Wedell machines seemed to be due to trouble with his power-plant, not to his flying tactics. Comparing the speeds on the fastest lap of the race with those previously made in the straightaway qualifications, it appears that rounding the turns cost Doolittle a 10 per cent drop of

speed and Wedell, Turner and Haizlip all lost about 8 per cent. As is likely to be the case, the fastest, highest-powered, heaviest ship paid the largest price in speed in making the turns.

If the Thompson Trophy race was lacking in dramatic episode, no such complaint could be made against the Aerol Trophy event, the women's championship. The weather stepped in to make that one of the most hair-raising affairs since the first National Air Races were held in 1920.

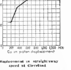
There were four starters—Mrs. Mae Haizlip in her husband's Wedell-Williams racer, Mrs. Gladys O'Donnell in the fastest of Ben Howard's fleet, which she never had flown or even taxied at high speed prior to the moment when the flag dropped to send her on the course, Florence Klingensmith in John Livingston's super-Monocoupe, and Mrs. Betty Lund in Art Davis' clipped-wing Waco. Never before had women pilots attempted to fly pure racing types. Mrs. Maude Tait Moriarty had planned to compete again in the Gee Bee sportster with which she won in 1931, but engine trouble prevented her from starting.

In the fifth lap a storm broke. Visibility on the ground fell to less than a mile. The rain streamed across the windshields and struck like bird-shot in the faces of the women flying open planes. Yet they kept on going, most of them by some miracle stayed on the course, and at least one held the throttle wide open throughout.

The other races can be described in a few paragraphs, and then covered by the listing of speeds and times on the next page. The 1,000-cu.in. free-for-all proved to be essentially a Wasp Junior monopoly. Haizlip got a short lead on Wedell at the start, and held it throughout. The fact that the race was flown around a 5-mile course, whereas the same ships flew a 10-mile course in the Thompson Race, made it possible to get some more data on the effect of turns on speed. It appears to be a general average rule that for heavily-loaded racing planes a 10-mile four-sided course is about 8 per cent slower than a straightaway, and a 5 mile course about 8 per cent slower than a 10-mile one.

In the A.T.C. events, the classification of entries by piston displacement, which had been much criticized in past years as illogical, had been abandoned in favor of a classification by an advertised speed. The new system also leaves much to be desired, making an arbitrary grouping with pronounced advantage for those ships which happen to have advertised speeds just below the limits set in the various classes, but it was exceedingly interesting to compare the speeds made in the races with the advertised figures and to see how much individual pilots had been able to accomplish by individual effort. In the 110-mile class the prizes went to a Great Lakes trainer and a OX-5 Travel Air, with speeds around the course equivalent to about 114 and 107 m.p.h., respectively, on the straightaway. In both cases the advertised speed was exceeded about 8 m.p.h. In the 140-mile class a Waco with seven-cylinder Whirlwind and a Warner Monocoupe were each pulled up to about 152 m.p.h. on the straight, with two other Monocoupes making about 146. The fairing of fittings and strut intersections on some of the Monocoupes was particularly beautiful, and one of them was reported to represent 800 man-hours of work by the owner, with the ultimate result of putting about 15 m.p.h. on to the advertised speed. In most of these cases, in all classes, the increase of speed by streamlining would probably be around 5 or 6 per cent, with the remainder of the gain made by running the engine up to a power and r.p.m. somewhat higher than that which the manufacturer rates the plane and by adopting a propeller and a pitch setting based only on high-speed performance.

Handicapping by a handicap committee was given a serious trial for the first time in the National Air Races, being used in two events. One of them, the Amelia Earheart Trophy Race, was marked by very erratic performance on the part of several contestants with little or no previous experience in pylon racing. Two of them flew off the course completely and ultimately landed, and others followed the route only very unsteadily. Miss Klingensmith, the winner, flew a beautiful race, and gained enough by close keeping of the course and by good turns to account for her victory over the other seven competitors. Flying the Warner Monocoupe belonging to John Wright, she started from scratch and flew through the whole field to win by 24 seconds, while the next three machines came in within the space of a quarter of a minute. In the other handicap event the limit ship was winner. A Taylor Cub, it was sent away one minute and eighteen seconds ahead of the next slowest plane in the race, and six minutes 58 seconds ahead of the scratch machine, a specially streamlined Warner Monocoupe. The scratch plane was catching up very rapidly at the finish, but hadn't quite reached the Taylor, which plodded across the line nine seconds in the lead. The first six planes, with speeds ranging from about 75 m.p.h. to about 150 more, all finished within the space of 30 seconds.



Displacement vs straightaway speed at Cleveland

The Derbies, the two divisions of the Cord Cup and the Leeds Cup contests were better managed and led to less controversy than ever before. It is no easy matter to measure the speeds of some 50 airplanes over a straightaway course and then to make sure that no changes are made in the planes thereafter, and the governing officials are to be congratulated on the accuracy and fairness with which the work was done. In most cases the tests by two different pilots showed speeds agreeing with each other within a mile an hour.

Of the acrobatic displays and miscellaneous vaudeville features at Cleveland, little need be said. Those who have ever seen a National Air Race can easily picture them to themselves. For reasons of governmental economy the Army and Navy played a much smaller part than ever before, but it was a more interesting part than in the past because their operations were more purely military and had less of the aspect of set pieces or parades. Particularly impressive was the Marine dive bombing with live miniature bombs, and with about 40 per cent of the bombs exploding within a 50-ft. radius of the target and practically all of them within 100 ft.

Free for All*

Event	Place	Pilot	Plane	Engine	Displacement	Time	Speed of fastest lap	Prize money
No. 1 115 cu.in.	1	Art Davis	Heath	Continental	115	14 00.79		$270
	2	Neumann	Loose	Lambert	100	14 19.75		150
	3	Mallor	Heath	Continental	115	18 21.48		90
No. 2 200 cu.in. 21 mi.	1	Art Davis	Heath	Continental	115	12 24.66	104.9	315
	2	Neumann	Loose	Lambert	100	13 34.52	96.6	173
	3	McCarthy	Church	Church J 3	108	13 50.76	85.2	105
	4	Sibley	Neumann	Continental	115	16 51.33	77.7	70
No. 3 350 cu.in. 21 mi.	1	Wittman	Wittman	Cirrus	540	8 31.66	162.2	360
	2	Howard	Howard	Gypsy	518	8 55.65	134.3	200
	3	Don Rae	Heath	Martin		11 41.78	128.3	120
	4	Neumann	Monocoupe*	Lambert	266	12 30.50	122.2	80
	5	Von Wald	Kadloh	Velie	251	14 38.09	102.8	40
No. 4 510 cu.in. 6 laps 3 mi.	1	Howard	Howard	Menasco	489	10 20.11	187.7	
	2	Leggett	Cessna	Warner	422	10 33.64	187.2	
	3	Livingston	Monocoupe	Warner	500	10 53.91	185.0	
	4	Ong	Howard	Menasco	489	10 40.71	180.2	
	5	Clempett	Ryder	Menasco	489	11 15.93	175.3	
	6	Wittman	Wittman	Cirrus	549	11 55.80		
No. 5 685 cu.in. 10 laps 5 mi.	1	Howard	Howard	Menasco	489	17 05.96	190.8	
	2	Ong	Howard	Menasco	489	17 22.58	180.2	
	3	Livingston	Monocoupe	Warner	500	17 31.51	182.2	
	4	Wittman	Wittman	Cirrus	540	18 32.40		
		Moore	Ryder	Menasco	544	Out lap 7	180.5	
No. 6 800 cu.in. 16 laps 5 mi.	1	Moore	Ryder	Menasco	544	25 26.50	202.0	
	2	Howard	Howard	Menasco	469	27 01.38	188.9	
	3	Leggett	Cessna	Warner	422	27 11.55	188.1	
	4	Livingston	Monocoupe	Warner	500	27 41.82	185.2	
	5	Ong	Howard	Menasco	489	28 55.28	178.5	
	6	Clempett	Ryder			29 19.00	175.1	
	7	Wittman	Wittman	Cirrus	340	30 21.38		
No. 7 1000 cu.in. 10 laps 5 mi.	1	J. Haizlip	Wed.-W'ms	Wasp Jr	985	14 44.93	244.2	787
	2	Wedell	Wed.-W'ms	Wasp Jr	985	14 47.85	234.4	457
	3	Gehlbach	Gee Bee	Wasp Jr	985	16 10.69	216.6	262
	4	Moore	Ryder	Menasco	544	16 44.46	203.4	175
	5	Ong	Howard	Menasco	489	18 14.25	183.7	87
No. 15 Thompson 10 laps 10 mi.	1	Doolittle	Gee Bee sport.	Wasp Sr	1344	23 44.69	266.6	4500†
	2	Wedell	Wed.-W'ms	Wasp Jr	985	24 44.56	255.0	2500
	3	Turner	Wed.-W'ms	Wasp Jr	985	25 44.78	246.0	1500
	4	J. Haizlip	Wed.-W'ms	Wasp Jr	985	25 56.30	245.8	1000
	5	Gehlbach	Gee Bee	Wasp Jr	985	27 08.90	255.2	500
	6	Hall	Springfield	Wasp Sr	1344	27 49.98	220.3	
	7	Ong	Howard	Menasco	544	31 24.69	199.1	
No. 22 Aerol Called at 4th lap	1	G. O'Donnell	Howard	Menasco	488	12 56.38	197.8	2250†
	2	M. Haizlip	Wed.-W'ms	Wasp Jr	985	15 06.34	212.8	1250†
	3	Klingensmith	Monocoupe	Warner	300	13 47.78	186.4	750†
	4	Lund	Waco	J 6-9		23 39.20	166.3	500

* C or NC. † and plaque

C or NC Planes

Event	Place	Pilot	Plane	Engine	Displacement	Time	Speed of fastest lap	Prize money
No. 8 110 m.p.h. 6 laps 3½ mi.	1	Hunt	Gt. Lakes	Cirrus M	310	17 52.64	105.3	$225
	2	Neumann	Travelair	OX 5	503	15 44.57	99.1	125
	3	Verna	Waco	Warner	422	15 45.44	98.1	75
	4	McDonnell	Gt. Lakes	Cirrus	304	13 58.20	96.6	50
	5	Dixon	N. Standard	Kinner K-5	372	14 55.58		25
No. 10 125 m.p.h. 6 laps 3½ mi.	1	Cessna	Cessna	Warner	422	10 56.52		270
	2	Hernaiz	Monocoupe	Lambert	266	11 34.58		150
	3	Chester	Davis	Warner	422	11 45.55		90
	4	Corrigan	Waco	Continental	544	12 15.72		60
	5	Machus	Gt. Lakes	Cirrus	310	12 30.44		30
	6	Krapp	Monocoupe	Lambert	266	12 50.83		
	7	McArthur	Stinson	Lycoming	680	15 56.70		
	8	Gipson	Aristocrat	Warner	422	14 40.55		
No. 11 140 m.p.h. 6 laps 3½ mi.	1	Art Davis	Waco	J 6-7	736	10 27.48	130.1	270
	2	Morris	Monocoupe	Warner	422	10 54.00	140.7	150
	3	King	Monocoupe	Warner	422	11 08.09	154.1	90
	4	Wright	Monocoupe	Warner	422	11 15.99	155.5	60
	5	Neumann	Monocoupe	Lambert	268	12 23.57	121.1	30
	6	Moore	Stearman	Wasp Jr	985	12 33.37	119.7	
No. 12 180 m.p.h. 6 laps 3½ mi.	1	Doug Davis	Travelair	J 6-7 D	760	9 35.08	153.9	270
	2	Art Davis	Waco	J-6-7	736	10 58.58	143.8	150
	3	Zeller	Laird	J-6		11 17.98	157.3	80
	4	King	Monocoupe	Warner	422	11 28.90	155.3	60
	5	Wright	Monocoupe	Warner	422	11 59.56	156.2	50
No. 13 OX-5 OXX-6 Race 6	1	Neumann	Travelair	OX 5	505	14 17.20	88.4	135
	2	Sherrink	Travelair	OX 5	503	14 55.00	85.2	75
	3	Hughes		OX 5	503	14 50.40	94.7	45
	4	Kling	Travelair	OX-5	303	15 39.68		30
Altitude Race to 1 mile and down	1	Art Davis	Waco			3 11.85		
	2	Wedell	Wed.-W'ms	Wasp Jr	985	3 14.76		
	3	de Seversky	Laird	J 6-9		3 29.99		
	4	Kossowski	Polish			3 20.72		

Handicap Races

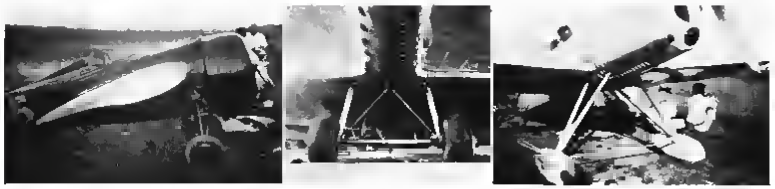
Event	Place	Pilot	Plane	Engine	Displacement	Start fixed by handicap	Finish Time	Prize money
No. 8 510 cu.in.	1	Havens	Taylor	Continental	115	00 00	15 59.61	$100
	2	Klingensmith	Waco*	Kinner B-5	441	04 15	15 48.50	100
	3	Morris	Monocoupe*	Warner	422	06 58	13 50.72	60
	4	Newrose	Aer-Klemm*	LeBlond	266	03 24	14 05.77	40
	5	McCloskey	Monocoupe*	Velie	251	02 55	14 07.71	20
	6	Sturtevant	Aristocrat*	Warner	422	04 08	14 09.71	
	7	Krupp	Monocoupe*	Lambert	266	05 29	14 18.56	
	8	Gallagher	Heath*	Continental	115	01 18	14 20.03	
No. 25 685 cu.in. Earhart Trophy	1	Klingensmith	Monocoupe*	Warner	422	07 05	15 07.59	
	2	Foltz	Bird*	Kinner	522	02 48	15 51.99	
	3	Bichey	Bird*	Kinner B-5	441	05 15	15 56.78	
	4	Sanson	Fleet	Warner	422	04 46	15 47.88	
	5	McCloskey	Monocoupe*	Velie	251	02 52	16 21.47	
	6	Trader	Trader Sp.	Continental		00 00	17 14.01	

Cross Country

Event	Place	Pilot	Plane	Engine	Displacement	Time*	Points	Prize money
Bendix Trophy	1	J. Haizlip	Wed.-W'ms	Wasp Jr	985	8 19 45.79		$6750
	2	Wedell	Wed.-W'ms	Wasp Jr	985	9 47 31.01		5750
	3	Turner	Wed.-W'ms	Wasp Jr	985	9 02 25.23		2250
	4	Gehlbach	Gee Bee	Wasp Jr	985	9 41 39.03		1500
Cord Cup (Atlantic Wing)	1	Huffman	Waco*	Continental	544		1100 150	
	2	Dorsett	Math*	Gypsy	518		1041 812	
	3	McCloskey	Monocoupe*	Velie	251		638 668	
	4	Cason	Travelair*	J 6	540		515 850	
	5	Neumann	Monocoupe*	Lambert	266		410 200	
	6	Robinson	Waco*	Wright			360 000	
	7	Sturtevant	Aristocrat*	Warner	422		256 500	
	8	Doug Davis	Travelair*	J6-7D	760		196 000	
	9	Fields	Travelair*	OX 5	505		106 665	
	10	Art Davis	Waco*	J 4	788		101 525	
Cord Cup (Pacific Wing)	1	Hunt	Gt. Lakes*	Cirrus	310		1814 250	
	2	Cessna	Cessna*	Warner	422		1525 980	
	3	Carnahan	Monocoach	J 6-7	760		1075 150	
	4	G.O'Donnell	Monocoupe	Warner	422		409 700	
	5	McDonnell	Gt. Lakes*	Cir Inv	504		477 788	
	6	L.O'Donnell	Waco*	Wright	426		550 500	
	7	Hardesty	Monocoupe*				221 750	
	8	Vickers	Pehld Kr21*	Kinner K-5	572		198 450	
	9	Waterman	Waterman*	Kinner C-3	713		176 100	
	10	Bleakley	Robin	Challenger	605		155 150	
Leeds Trophy	1	Zeller	Laird				322 150	
	2	Wright	Monocoupe*	Warner	422		274 175	
	3	L.O. Yost	Waco*	Continental	668		150 650	
	4	Goldsmith	Travelair				152 500	
	5	Goddard	Monocoupe				118 800	
	6	Couper	Kell't Autogiro				90 300	
Cincinnati Trophy Race						*Cleve.-Cinn.*	*Cinn.-Cleve.*	*Total Time*
	1	Livingston	Monocoupe	Warner	300	1 08 55.05	1 08 56.54	2 17 29.59
	2	Wittman	Wittman	Cirrus	540	1 13 40.05	1 10 27.12	2 24 16.17
	3	Leggett	Cessna	Warner	422	1 08 49.05	1 25 50.68	2 32 39.73
	4	Art Davis	Waco	J-6-8		1:24 02.55	1 23 57.68	2 47 40.23
	5	Edwards	Monocoupe*	Warner	422	1 28 05.55	1 27 40.90	2 55 44.45
	6	Homer	Laird	Warner	422	1:28 14.05	1 29 40.29	2 57 54.54
	7	Harts	Cessna*	J 6-8	872	1:42 51.05	1 32 23.56	3 14 54.61

Straightaway Trials

Event	Place	Pilot	Plane	Engine	Displacement	Av. speed (m.p.h.)		Prize money
No. 28 Speed Dash	1	Doolittle	Gee Bee	Wasp Sr	1344	294.550		$1575
	2	Wedell	Wed.-W'ms	Wasp Jr	985	277.057		875
	3	Turner	Wed.-W'ms	Wasp Jr	985	266.674		525
	4	J. Haizlip	Wed.-W'ms	Wasp Jr	985	266.440		350
	5	Gehlbach	Gee Bee	Wasp Jr	985	247.350		175
	6	Hall	Springfield	Wasp Sr	1344	245.717		
	7	Moore	Ryder	Menasco	544	237.758		
	8	Howard	Howard	Menasco	489	213.855		
	9	Bowen	Israel	Menasco		202.490		
No. 20		M. Haizlip	Wed.-W'ms	Wasp Jr	985	254.450		673
		Klingensmith	Monocoupe	Warner	500	198.611		375
		Lund	Waco	J-6		170.795		225



Aviation photos

Design at the races

THE airplanes which come to the National Air Races to compete in the free-for-alls can be divided into three groups. There are the products of large manufacturers, such as Waco and Monocoupe, which have been privately modified by clipping the wings, by taking special care with fairing and the reduction of interference, and by increasing the engine power. There are planes built especially for the races by comparatively small producers specializing in custom-built ships such as Gee Bee, Laird and Hall. Finally there are planes turned out by individuals or small groups not regularly in the airplane business, such as the Howard, Keith Ryder, and Wittman designs. One would expect to find a fourth group composed of the specially designed entries of great factories with massive engineering organizations, but there has been little of that since the United States Government stopped buying racers from Curtiss in 1926.

With airplanes produced under every imaginable condition and backed by every degree of engineering talent and experience, it is not to be expected that any very consistent trends can be traced. Many individual fancies are present; yet even so there are a few points on which there seems to be little or no difference of opinion. On one point, the preference for the monoplane over the biplane, there is virtual unanimity.

Up to 1929 practically all American racing planes were biplanes. In 1930 a biplane won the Thompson Trophy race and in many of the other events at Cleveland, but they were in a minority. The wire-braced monoplane is the favorite. The first five machines in the Thompson were all in that class, as are Ben Howard's two new Menasco racers and both of the most successful light planes. The Keith Ryder ship with the large (544-cu.in.) Menasco was the only rantilever plane to have any marked success.

Among the wire-braced machines the majority, including the Gee Bee, Wedell-Williams and Howard ships, are low-wing monoplanes with lift bracing to the landing gear and landing wires to the top of the fuselage.

There is a considerable difference of opinion about the arrangement of the lift wires, which of course had to be governed to some extent by the landing gear design. In the Gee Bee there are two wires diverging from a common point of attachment in the landing gear just behind the wheel, the wire to the rear spar being inclined back enough to have a substantial component resisting the drag forces at maximum speed. The Wedell-Williams has three wires, two running from a point just behind the wheel to the two spars, one from an anchorage just above the wheel to the front spar. The component of wire tension against the drag was less than on the Gee Bee. At first sight the arrangement appeared as a somewhat inefficient one, since the rear spar stresses are ordinarily the most severe in a raring plane of very high speed range ratio. In the Wedell-Williams and the Gee Bee, however, the rear spar loads at low angles had been lightened by the use of wing sections of the N.A.C.A. "M" series with upturned trailing edges and a very limited center of pressure travel. Even at 250 miles an hour the front spar would carry approximately half the wing load, whereas on a section like the Clark Y under like conditions the center of pressure would actually be behind the rear spar and there would have been a torsion in the wing with the spars carrying opposite loads.

Aviation

Landing gears and fuselages in the medium-powered classes. At top left: The Cessna's wheels swung outward and all into the fuselage. At top center: The Keith Ryder's pulled back into the wings. At top, right: Ben Howard took a tip from six-wheel truck practise and used dual wheels. Above: The Keith Ryder had a new improved windshield and head rest.

The faring together of wing landing gear, and fuselage to eliminate interference is receiving more attention than ever before but in some cases the fillets used indicate good intentions rather than a careful study of the results of wind tunnel tests. In particular, some of the machines seem to have a fillet of unduly large radius near the leading edge of the wing and to decrease the radius too rapidly toward the trailing edge so that the effective airfoil section immediately adjacent to the fuselage has an inordinately deep camber.

The major aerodynamic problems of the fuselage are of course those of cowling and of cockpit arrangement. The extent to which the radial engine has captured the American industry was evidenced by the use of radials on the first six machines in the Thompson race, in spite of the admitted aerodynamic handicap of the type on machines of very high speeds. Recent developments in cowling have of course gone far to reduce the radial's handicap, and all of the planes with Wasp or Wasp Junior engines, together with some of those having Whirlwinds and Warners (notably the Cessna racer) had the full venturi or N.A.C.A. cowling. The forms used, however, varied widely. In the Gee Bees, with their huge fuselages having a maximum diameter exceeding the engine diameter by a foot or more, the cowling flares out steadily to a maximum diameter at the trailing edge some 6 or 8 in. greater than the diameter over the cylinders, and then leaves a relatively narrow annular passage only about 4 in. wide for the escape of air. The Wedell-Williams and the Hall planes, with fuselages of much smaller maximum cross-section, contract the cowling diameter after passing the cylinder heads and then leave, especially on the Wedell-Williams ships, an annular opening wider than the Gee Bee's.

The cowling of the inverted air-cooled engine used on a number of smaller ships is of course a more straightforward problem, and the only marked difference of opinion bears on the best way of getting the cooling air out of the fuselage after it has passed over the engine. Almost all of the Menasco-engined ships, and particularly the Keith Ryder, supplement a few louvres for exit by a rectangular opening about 6x9 in. on the left side of the fuselage near the rear of the engine. In the faster of the two new Howard planes, however, the dependence is entirely on stamped louvres, of which there are a great number on the left side of the fuselage and approximately a third as many on the right.

Exhaust disposal is an easy problem with the inverted in-line engines, but on the radials an improper location of the exhaust outlets may be disastrous to the efficiency of a cowl. The Hall plane originally followed an unusual practice in bringing the exhaust pipes out through the cowl and breaking them off flush with the surface about a foot short of its rear edge. Before the Thompson race Mr. Hall put on new exhaust stacks discharging inside the cowl and closed up the openings in its surface, but there appeared to be but little change in speed as a result. The Gee Bee turns the exhaust loose inside the cowl to find its own way out at the rear edge, and the gas obviously stacks close to the fuselage, leaving marks of its presence for 8 or 10 ft. behind the cowl. The Wedell-Williams planes have a particularly interesting arrangement (shown in one of the photographs on this page), with stacks brought to the rear of the cowling and beveled off flush with its edge.

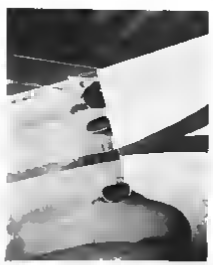
Cockpit arrangements are, on the whole, better than last year, especially with reference to vision. The Gee Bee has a permanently installed windshield and cockpit cover faired directly into the fin, with the windshield about 3 ft. forward of the rudder post. It is of course, extremely blind ahead at low speed, but at maximum speed the pilot was reported to be able to look directly along the course. Although the cockpit cover was removable in emergency, access to the pilot's seat is normally had through an opening about 27 in. square on the right side of the fuselage.

The Wedell-Williams cockpit installation, like the fuselage section, was much more normal. The cockpit cover, which rises to a maximum of about 5 in. above the top of the forward part of the fuselage and gives the pilot a view straight ahead, slides down to the side to open the cockpit.

Cockpit arrangement on the planes with vertical engines in general follows the line established by Howard's Gypsy-powered ship two years ago and by the Keith Ryder planes last year. The cockpit sides are hinged, and close in after the pilot gets in to leave an opening just large enough for his head. The seats are practically on a level with the

Aviation

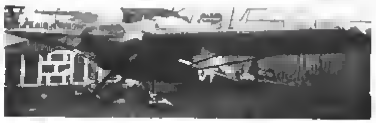
Above: The Ismels Special was a "roll-wing upside down." Left: The Brown monoplane, with the central part of the cockpit covering removed.



Aviation

Thompson Trophy competitors. Above, left: The Wedell-Williams exhaust was led back to the edge of the cowl. Left: Turner's Wedell-Williams. Below, left: Doolittle's winning Gee Bee. Below, center: The Hall was the only strut-braced entrant and the only one with high wing. Below, right: The Gee Bee in stern view was mostly fuselage.

rudder pedals, and in general the airplane has the appearance of having been molded around the slenderest pilot to be found. The notable exception to the general rule for these light planes, and perhaps the most remarkable contribution to streamlining at the races, was seen in the Brown ship, in which the cockpit makes no break or reversal in fuselage contour. The top line of the fuselage in profile is brought back in a perfectly smooth curve to about 6 in. above the top of the engine and then down to the tail, and the top and part of the left side are covered with pyralin over a length of some 5 ft. The pilot is completely enclosed in a form which would be perfectly streamlined if it had not had to be rounded somewhat to fit the nose of the engine, and looks out through a windshield



The Loose Special was a successful home-made light plane. Above: There were some beautiful jobs of wing strut fairing on Monocoupes

making an angle of about 10 deg. with the fuselage axis.

With the growing popularity of high-powered engines and totally-inclosed cockpits, gassing of the pilot becomes an increasingly serious menace, and forced ventilation must be provided. In most of the totally-inclosed planes the air lead is taken to the cockpit from inside the cowl and well forward of the point of discharge of the exhaust, but in the Wedell-Williams machines the air is led in from ¾-in. holes bored in the leading edge of the wing just outside the slipstream. Ben Howard's new planes make sure of a supply of fresh air directly to the pilot by having some 30 or 40 holes of ¼-in. diameter drilled in the windshield.

The greatest landing-gear surprise was the scarcity of retractable gears. With but three exceptions the builders of racing planes had elected to leave the landing gear rigid and use it as a base for the anchorage of the wing truss. Most of the wire-braced monoplanes follow the Gee Bee and Wedell-Williams in having the landing gear struts totally inclosed inside a streamlined casing which is an upward continuation of the "pants."

In most instances the landing gear bracing is completed with a cross-wire between the wheels and a pair of diagonals in the transverse plane. The Gee Bee has only two wires, and instead of being fully crossed diagonals they run from the wheels to a meeting point on the bottom of the fuselage. The Israel Special is remarkable for having no diagonals at all, transverse loads on the landing gear having to be taken entirely through the wing truss and the landing gear having no wiring except that to the wings and a single cross-wire between the wheels.

The retractable gears (both of them illustrated on page 402) were on the Cessna and Keith Ryder. The Brown monoplane had also been designed for retractable wheels, but was not completed in time to install the gear according to the original plan, and was fitted instead with cantilever struts carrying very-completely-inclosed wheels. The change, and the completeness of the streamlining on the wheels, apparently were responsible for the damage to the ship in the first attempted takeoff. The field was very muddy and indications were that the "pants" clogged and locked the wheels. The only other cantilevered gear was on the Hall monoplane, and in that case the struts were pivoted at the point where they entered the fuselage and carried shock absorbers at their upper end inside the fuselage, as in certain Dornier military planes of many years ago. The Gee Bees of course have their customary arrangement of shock absorption, with the wheels carried in a fork pivoted just behind the axle and the shock absorber in a fork directly above the axle. Many of the other racing planes had no shock absorbers at all, depending entirely on medium low-pressure tires.

Most remarkable landing-gear innovation of all was Ben Howard's use of pairs of wheels in tandem on the faster of his two new racers. Two wheels about 12 in. in diameter are carried some 2 ft. apart in a double fork pivoted at its central point to the lower ends of the landing-gear struts, so that however the machine may be inclined all four wheels always bear upon the ground.

The races brought no remarkable innovations in structures, nor in controls and control surfaces. Plywood covering continues in general favor, as for eight years past. Where metal was used there was no attempt to countersink rivets, as the British had done in their Schneider racers, and fuselage surfaces were scattered with hundreds of protruding heads. There seems to be a tendency to increase the aspect ratio of tail surfaces. Balanced control was nonexistent, although some of the fastest ships, the Gee Bee among them, have the ailerons statically balanced with weight forward of the hinge to reduce the danger of flutter. Aileron chord, on the other hand, was surprisingly large in most cases, the ailerons being mounted directly on the rear spar. On the Gee Bees, for example, the chord is about 15 in., yet the aileron control was reported to be very easy and sensitive.

The Gee Bee's tail is affected by the cockpit in the leading edge of the fin. The width of the fuselage has to be carried right on through the tail, and the maximum thickness of the rudder at its hinge is about 10 in. The fact that control could be secured with such small surfaces as were used, behind a fuselage of such enormous dimensions, was an adequate testimonial to the smoothness of the flow of air about the fuselage and to the way in which the streamlines closed in behind the maximum section to flow across the tail surfaces. It would have probably been quite impossible to build such a ship with any type of cowling known up to four years ago, or without the N.A.C.A. cowl. The flow of air would be so turbulent and confused as virtually to miss the tail surfaces, and the machine would be quite uncontrollable.

Engines and engine accessories were much as in the past. All the makes of engines seriously engaged in the competition had been supercharged from a normal rating of about 3 hp. per cu. in. of piston displacement to a peak racing output of a little over ½ hp. per cu. in. The Wasp Junior was putting out about 540 hp., the Senior Wasp in the Hall and the Gee Bee about 750, and the Menasco about 260. Increased power and decreased wing dimensions were making a little trouble with torque, but it has not yet become serious enough to require any such major modifications in structure as the British have had to put into their racing sea planes to overcome the torque when getting off. The really significant power plant innovation of 1932 was the appearance of controllable pitch propellers on the race course. Both the Standard and the Smith were represented, the former on the Hall plane and the latter on the Gee Bees. Both functioned without any apparent mechanical difficulties, and were of great assistance in getting away quickly. On the plane which won the Thompson Trophy, the Smith propeller was set for an extreme range of from 20 deg. to 28 deg. pitch angle, and was run up against the stop for the maximum setting as soon as the plane was in flight.

Airplane designing for economical operation

The S.A.E. starts a new argument on an old subject

THE aeronautical world is interested in the economics of transport plane design. If anyone doubted it he need only have attended the S.A.E. meeting at Cleveland during the National Air Races to be convinced. Most largely attended, and productive of most heated debate, was the session at which Frank T. Courtney, renowned test pilot, well known to readers of AVIATION for his articles in these pages, spoke on "Air-Transport—Design Economy and Air-Transport Testing," and George A. Page, Jr., of the Curtiss-Wright Airplane Company of St. Louis, presented an exhaustive analysis of "The Economic Aspects of Transport Airplane Design" prepared by Ralph S. Damon, in charge of the commercial manufacturing activities of Curtiss-Wright, Mr. Page himself, and Kendell Perkins.

Conservatism finds advocates

The two papers were prepared quite independently, but they arrived at very similar conclusions. Both aligned their authors with the conservative school of thought in airplane design, as opposed to the holders of the ultra high-speed doctrine. Mr. Courtney was particularly sceptical not only about the economic virtues of 200-mile cruising speeds, but about the real value of a large proportion of the innovations offered in design, equipment, and operating methods in the last few years. He was sceptical about cantilever monoplanes, and about all metal structures, and about retractable landing gears. He was extremely critical of current illusions on the possibility of taking standard commercial airplanes, already of good design, and increasing their speed by some 20 miles an hour without sacrifice by "cleaning up." "If that can be done," said Mr. Courtney, "it speaks badly for the original designer of the plane, but as a rule it cannot be done without sacrifices in weight and complication which make the net gain very questionable."

In any case, he demanded that all matters be judged purely by an economic yardstick, and he denied the often-heard declaration that "the first object of air transportation is speed." "The first object of air transportation," said Mr. Courtney, on the other hand, "is the profitable carrying of loads from one point to another. Speed is the second object."

He was particularly critical of cabin design. Most cabins he thought too crowded, yet he objected to lengthening the cabin and so placing certain unfortunate passengers very far from the center of gravity of the ship and in a position uncomfortable in rough air. He recommended seating the passengers either side by side or vertically above each other, as in the Long Island Railroad's new commuting cars. The particular charm of the double-deck arrangement was found in its making full use of the height of the cabin, permitting full headroom in the aisle and yet wasting no space over the seats where space is unneeded.

Admitting that the problem of ice formation on wires is still with us, the author nevertheless argued for the greater use of external streamline-wire bracing. He believed it both lighter and aerodynamically more efficient than the internally-braced cantilever construction, and he pointed to the use of wire bracing on all successful racing planes to prove his point. To get the full benefit of wiring, however, Mr. Courtney felt that the wing truss and the landing gear should be considered integrally, and the landing gear used as a base for wire attachments. That would prohibit the retractable landing gear, which he believed cost more than it was worth, in weight and otherwise, in any case. He thought that retractable landing gears had become a perfect fetish in recent months, and that a determination to retract the wheels was being taken as the one fundamental element about which certain modern designs were developed. The Bellanca Airbus came nearer to his own idea of a proper landing-gear installation.

From general design Mr. Courtney moved on to testing, which seemed to him to have been grievously neglected. Too often, he thought, flight testing was considered to have been completed when it was decided that a new machine would be able to get through the Department of Commerce test. In his own opinion, the Department's requirements should be taken as a minimum, which should be far exceeded by any really good plane. That was particularly true of transport planes, which must be flown many hours a day and through much bad weather. On transport types, nothing was "good enough" so long as a fault could be found with it.

As a particular example, Mr. Courtney dwelt upon the testing of multi-engined planes for their ability to fly with one engine dead. Such machines were sometimes considered to be "good enough" if it were possible for a pilot to hold them straight and level after throttling one engine back at a considerable altitude. The same machine, however, might crash if one engine failed on a takeoff when the pilot wasn't ready for it and when it was traveling at low speed. Mr. Courtney thought that inexcusable, and believed that "it is possible and even easy to design rudder control so that on the failure of one engine no particular effort is required on the part of the pilot to maneuver the plane." He attributed a good deal of the trouble from improper testing to the pilot's pride in his own skill, leading him to feel that any criticism of the airplane would be a confession of his own inability to handle it. "An exceptionally skilled pilot should use his skill to find defects, not to overcome and hide them."

Wanted—critical pilots

The author of the paper found fault not only with the spirit in which testing is often undertaken but also with its inadequate extent sometimes resulting from an attempt to hurry it through.

He considered no plane properly tested until it had been flown with all sorts of loading conditions and in all sorts of weather. In particular, he insisted that testing of a new type should include blind flight, both with full power and with various combinations of engines cut out.

Mr. Courtney's paper was qualitative,

and was written from the point of view of a critical and observant pilot of immense experience. The contribution of the Curtiss-Wright group, on the other hand, was almost purely analytic, an attempt to figure out the most efficient and economical combination of design elements. The general method of approach, comparing imaginary airplanes of constant efficiency and varying in some one particular of design, was the same as that used by the editor of AVIATION in a paper presented to the S.A.E. three years ago. [Reported in AVIATION, Aug. 31, 1929], but the field covered was considerably more extensive, and the fundamental data used were somewhat different.

It was assumed in the paper that direct operating costs, including insurance, would make up 60 per cent of the total operating charges of an airline, and that the other 40 per cent would come from overhead. It was further assumed, in the light of railroad experience, that passenger fares could be about 10 per cent higher for the fastest and most comfortable airplane than for one of mediocre speed and comfort, and the authors suggested a maximum fare of 5 cents per mile with the speediest and best possible service as a future prospect.

Lengthening airplane life

Proceeding to detailed calculations of expense, the economic life for determining depreciation was taken as 5,000 hours for the airplane and 2,500 hours for the engines. Those figures are, of course, substantially above the assumptions usually made in the past, but they are in accord with actual operating experience of the last few years.

Maintenance and overhaul of the airplane structure was taken as approximately 0.01 cent per hour for every dollar of airplane cost. It was further assumed, on a basis of certain comparative airline accounts to which the author has had access, that the maintenance cost for an all-metal airplane would be at least 40 per cent higher, other things being equal, than for one covered with fabric. That suggestion aroused a good deal of dissension during the discussion, and the friends of metal indignantly denied that any such ratio could be typical.

Engine maintenance was assumed at 0.55 cents per hp.-hr. (The assumption made by the authors of the paper on engine maintenance cost was identical with that used by the editor of AVIATION in his article on value of weight saving in the September issue. The airplane maintenance figure assumed by Messrs. Page and Damon was, however, only one-quarter of that taken by Mr. Warner. As both figures were supposed to be based on direct application of airline experience the discrepancy is astonishing.)

Before analyzing the question of economical speed, the authors investigated the relative advantages of various engine combinations. Taking existing planes as their guide, they assumed twin-engined machines to be 7 per cent more efficient than single-engined monoplanes without retractable landing gear, and those with three engines to be 7 per cent below the single-engined types in aerodynamic efficiency. A retractable landing gear was believed to be worth about 10 per cent in maximum speed for a given power and wing area, and it was anticipated that in every case 22 per cent of the gross weight could be put in the form of payload. Mr. Courtney would have disagreed with that, as his principal argument against the retractable landing gear was that a large part of what should be payload had to go into the retracting mechanism.

It was finally concluded that the twin-engined plane had a substantial advantage over the single-engined type on the score of safety, and a marked advantage over all other types in comfort and quietness. The Bureau of Standards test was quoted as showing a cabin noise level in a twin-motored type fifteen decibels below that on a typical tri-motor. (For those not familiar with the decibel scale, it may be explained that the conventional noise level in an airplane cabin lies about 30 to 40 decibels above that in a railroad train. A reduction of fifteen decibels is, therefore, a gaining of half the ground required to attain equality with competitive forms of transportation.)

Monoplane or biplane?

The choice between the monoplane and biplane was believed to depend upon the size and landing speed. For a large transport plane with a moderate landing speed the authors thought the biplane definitely superior, if only because hangar storage became so much simpler and cheaper. Having decided on two engines, and having made it apparent that they looked with favor on the biplane with a wing loading of not more than 16 lb. per sq.ft., Messrs. Damon, Page and Perkins went on to their actual cost analysis. They assumed a 12-passenger plane carrying a one-man crew, a 1,200 mile route with five intermediate stops, a 60 per cent load factor, and a 95 per cent reliability factor. The frequency of schedule would require seventeen airplanes, and a total passenger revenue of $1,025,000 was offset by a total direct operating expense of $960,000 for planes cruising at 140 m.p.h.

Lowering the cruising speed from 140 m.p.h. to 120, and decreasing the rate of fare by 5 per cent, the net profit on passenger operation increased from $65,000 to $80,000. Increasing the cruising speed to 160 m.p.h. cut the profit to $3,000, even in spite of a further increase of 5 per cent in the passenger fare, bringing it to 5.25 cents per mile. Of course it is very difficult to generalize on such matters as this, for the fares that will have to be set and the load factors that can be maintained will depend on what competing services are available and what conditions of service they offer. Neglecting those points, however, or assuming a general average of conditions, the figures seem to justify the authors' first conclusion that: "In the case of the fictitious airplane and the airline chosen, and in the absence of speed competition, it is better economy to use a low speed if any increase must be obtained by use of more power alone." A subsequent analysis on the effect of speed changes secured by improvement of aerodynamic efficiency without change of power showed, as might be expected, a very rapid increase of profit with increase of speed. An obvious corollary of the two studies, however, would be that the increased aerodynamic efficiency of the high-speed plane could also be built into a machine of lower power with the original speed still maintained. The efficiency change which increased cruising speed from 140 to 160 m.p.h. without change of power would also have made it possible to reduce the power about 30 per cent in the 140-mile ship. Using the same method of calculation employed by the authors (although this particular figure was not embodied in their paper) showed almost exactly the same profit with the high-efficiency planes at 140 m.p.h. as 160 m.p.h. It appears, and it will probably be found to be a general rule, that the economic speed increases, for a given landing speed, as the aerodynamic efficiency of the plane increases. In the case taken by the authors as typical of good present-day design practice, the most economic speed came out somewhere around 120 m.p.h. With a 15 per cent increase in speed for the same power, corresponding to a 15 per cent increase of K in the well-known equation

$$V_{max} = K\sqrt[4]{\frac{P}{S}}$$

the most economical cruising speed was raised to about 150 m.p.h.

The economics of weight

The last step in the paper's analysis was to compare two planes of equal power and speed, but differing in structural efficiency and so in the number of passengers that could be carried within the allowable gross weight, and differing also in cost. The purpose was essentially the same as that of Mr. Warner's article in the September issue of AVIATION, but the method was somewhat different and considerably higher figures were obtained for the value of weight saving. Messrs. Damon, Page and Perkins concluded that weight saving in a transport plant is worth something like $25 per pound, while the discussion in AVIATION had led to an average of about $10 per pound. The discrepancy, however, was rather apparent than real, as the figure in the current paper was designed to represent the price that could be justified for providing an additional pound of payload in a ship of given power and overall dimensions, while Mr. Warner's figure assumed a constant payload and represented the direct value of a reduction of 1 lb. in the empty weight of the plane. It is, of course, natural that the first figure should have been considerably larger than the second. Taking the difference of basis into account, the two sets of calculations were actually in very good agreement.

Controversy on landing gears

The two papers finished, the discussion was unleashed. Heracho Alfaro, lately of the Autogiro Company's engineering staff, took up the defense of the retractable landing gear against Mr. Courtney's attack. Far from cutting down the payload, he considered that the improved aerodynamic efficiency made it possible to increase the wing area for a given power and so to add to payload. Mr. Courtney admitted that, but pointed out that the weight per horsepower would then be increased and the climb and take-off qualities damaged. Furthermore, the retractable landing gear increased maintenance cost. Luther Harris of American Airways, chairman of the session, challenged him on that point. Mr. Harris had found that retractable landing gears often decreased the maintenance cost, as they required no streamlining and left all the landing gear parts open for inspection and work, whereas it sometimes took $10 worth of labor to remove the "pants" over a non-retractable wheel. Mr. Harris further disagreed with the authors' suggestion that a retractable gear added about 200 lb. weight to the plane. He thought 20 lb. ought to be enough. Mr. Courtney's reply to that was that the 200-lb. figure was based on a particular plane actually in service, that maintenance trouble with retractable landing gears arose not only in the joints but in the electrical operating mechanism and other auxiliaries, and that the case of the irremovable pants quoted by Mr. Harris simply represented inexcusably bad design. Landing gear streamlining could be so designed that it could be stripped with practically no effort.

Herbert V. Thaden, of the General Aviation Corporation, had a good many questions to put to Mr. Page. Long an exponent of metal construction, he questioned the ratio stated between overhaul cost for metal and for fabric covering. So far from all-metal planes costing from 40 to 100 per cent more than fabric-covered ones to maintain, he believed that they were decidedly more economical than their rivals. Such airline experience as he had been able to collect showed the metal structures to have an advantage of about 33 per cent in maintenance and overhaul costs, almost exactly the same ratio as that which the Damon-Page-Perkins paper had established in favor of fabric.

Mr. Thaden would be glad to build slow planes of high load capacity per unit of power if there were any demand for them, but it seemed to him only too plain that the operators wouldn't accept 120 m.p.h. and couldn't be made to do so. His ideas on landing speed were less conservative than those of the authors of the paper. He thought materially higher wing loadings were an early prospect, and that we must accommodate ourselves to them if we were to get maximum speeds high enough to satisfy the operators.

Three-engined virtues

Mr. Thaden also doubted the universal truth of the allegations of low efficiency of three-engined planes. He was confident that three-engined monoplanes could show values of K well up to those quoted by the authors for single-engined and two-engined designs. In connection with the effect of the number of engines on safety, he thought there hadn't been enough mention of operation at high altitudes. A twin-engined plane might do very nicely near the Atlantic Coast, but it took a three-engined job to show up properly when one engine stopped near Albuquerque. As for noise, the quietest engine that Mr. Thaden had ever flown in was single-engined, and that was all the proof he wanted that an engine in the fuselage imposed no fatal handicap on efforts for silence.

The editor of AVIATION hoped that there would be increasing appreciation of the importance of such analytical studies as had been made by the Curtiss-Wright group. Too often, he believed, cruising speeds and other characteristics were fixed by a fundamental assumption based on somebody's hunch or emotional desire, and it was taken for granted that any analysis made thereafter that didn't give results agreeing with the assumptions must be "theoretical" and therefore wrong. Too often also, general conclusions were based on a comparison of particular types of widely different characteristics and efficiency. Obviously it was absurd to draw conclusions about the most economical operating speed from a comparison of an up-to-the-minute machine, highly streamlined and fitted with retractable landing gear and all the other modern improvements and a four-year-old plane with no proper cowling on the engines and with no apparent attention given to interference between struts in the landing gear and wing structure. Yet conclusions were often based on comparisons quite as ridiculous as that. The only way to avoid it was by getting back to first principles and adhering to certain standard characteristics throughout the analysis, as the authors of the present paper had done.

William B. Stout rejoiced in hearing a paper which treated economy as the fundamental element in airplane design. He wanted to stand on guard, however, against drawing unduly general conclusions. Conditions change, and we must be ready to change with them. The development of airplane design practice over the last ten years, for example, had been governed very largely by the types and sizes of engines that were available. Planes and engines were now lasting three times as long as would have been thought possible five years ago. So far as metal wing covering is concerned Mr. Stout, who was the first of its active protagonists in this country, agreed that it was costly to overhaul a metal structure where the covering had to be removed, but there was no question that it saved money where the wing was so designed that a man could get inside and inspect the structure and make minor repairs without stripping the skin. As for cruising speed, Mr. Stout was all for economy, but he was afraid that very seriously mistaken conclusions might be drawn if we studied the subject with reference only to flight through still air. He believed that 100 miles an hour ought to be the minimum actual rate of travel under any normal conditions, and that we needed a 140-mile cruising speed to make the 100-mile rate good against a 40-mile wind. At the same time he was wholly out of sympathy with any move to increase cruising speed by piling on more and more power, and he foresaw the necessity of revolutionary aerodynamic developments to improve performance and at the same time cut costs to well below the minimum present levels.

Mr. Page replied that maintenance figures, and especially the comparison between cost for metal and fabric-covered wings, were based on data from several operators. He didn't believe that 120 m.p.h. would be the ultimate cruising speed of transport planes, and in fact he himself had been engaged in the design of a faster ship, but he and his colleagues offered their analysis for what it was worth, and subject to the assumptions on which it was based. He conceded the advantages of the tri-motor for operation in high-altitude country. The retractable landing gear was forcing itself on the manufacturers, in spite of Mr. Courtney, by the operators' demand for more aerodynamic efficiency. On one 1,300-hp. ship with which Mr. Page was familiar, retracting the landing gear saved 225 hp. at cruising speed. Even if the gear weighed 200 lb., as Mr. Courtney feared, it would save its own weight in fuel in a couple of hours' cruising.

A portion of Candler Field from the air. The large group of buildings in the center is Eastern Air Transport's Atlanta Depot. The new municipal terminal building appears in the middle with an American Airways hangar in the foreground.

THE FIFTH ARTICLE OF A SERIES ON MAINTENANCE

Controlling costs by planning

Some observations on Eastern Air Transport's Atlanta Repair Depot

ALTHOUGH the antics of the so-called "efficiency" experts have brought the term into some disrepute during the past decade, intelligent and careful planning still remains the *sine qua non* of any successful business enterprise. The more complicated and widespread an organization becomes, the greater the need for adequate supervision to eliminate waste of labor or material. Following a pattern of growth readily traceable in almost every other industry, the airlines in their evolution from the small isolated units of five years ago into the great systems of today, have long since passed the point where a single individual could satisfactorily fulfill all the duties of "grease monkey" to traffic manager or chief pilot. Not only do the actual flight operations involve a wide variety of interdependent functions, but the care and maintenance of a fleet of airplanes and their engines has required the establishment of repair bases and servicing stations, the hiring and supervision of skilled personnel to man them, and the supplying of thousands of dollars worth of supplies annually, ranging from carpet tacks to complete power plants.

It is only natural at this stage of the game that there should be some diversity of opinion among airline operators as to how best to obtain the maximum co-operation among the various departments. On some of the existing lines, for example, United Air Lines and Transcontinental and Western Air, Inc., the responsibility for the co ordination of all operating and maintenance functions rests with the division operating superintendent. Other systems, of which Pan American Airways and Eastern Air Transport are outstanding examples, have set up more or less independent engineering departments headed by a divisional or chief engineer, who, although exercising no direct authority over the routine details of operation, acts in an advisory capacity, and is generally responsible for the co-ordination of effort with particular reference to the maintenance of the equipment and the services of supply.

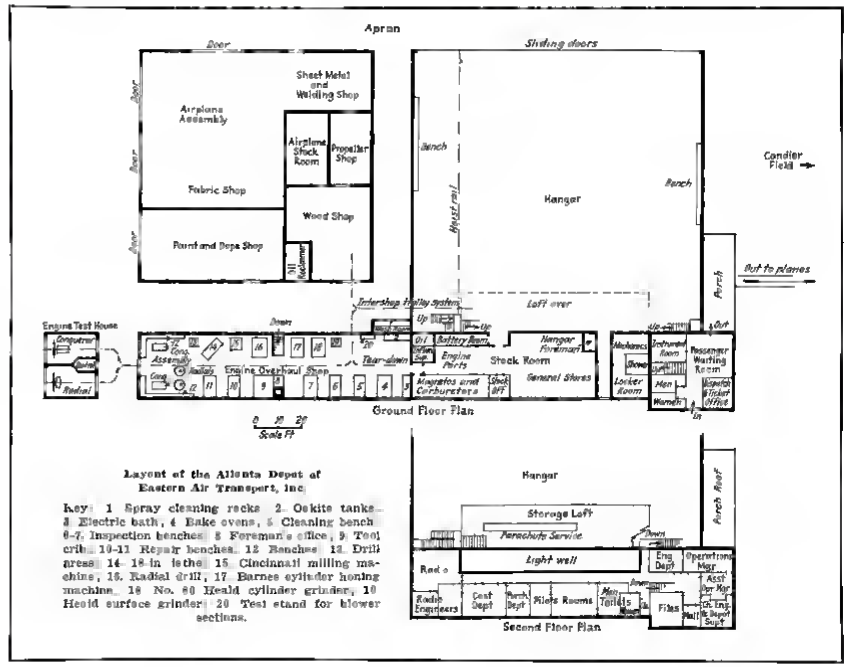
Close co-operation

One of the most interesting and significant factors in Eastern Air Transport's maintenance policy is the close cooperation which has been developed among engineering, maintenance and purchasing departments. By careful planning and supervision, a system has been evolved whereby it is definitely known in advance just what engines and airplanes are going to come into the shops for servicing and overhaul at any given period, the probable extent of the work which must be done on each unit, the exact amount of material which must be on hand to complete the work, the approximate number of man-hours required for each operation, and the date on which the equipment must be ready to be returned to service. The heart of the system is a chart which is kept in the chief engineer's office at the Atlanta Depot, on which are posted daily from the airplane and engine log books the total number of flying hours for each airplane and engine. By keeping a careful check of this running record it is possible to predict when a particular engine or airplane is due to come into the shops for overhaul. The principal concern is to so arrange the flying schedules that no more than a given number of ships or engines will turn up at the shop for overhaul at the same time. Under normal conditions, by dispatching certain airplanes more frequently than others, or by holding a ship out of service for a day or two, it is usually possible to maintain a fairly uniform flow of work through the shops. Occasionally emergencies crop up which may disrupt the schedule, but such occurrences are becoming more and more rare, and as the workings of the system become better understood, any minor disturbance in flow is less likely to upset seriously the routine procedure.

The keeping of such a schedule is only a starting point. Not only does it smooth out shop operations, making it possible to carry on day in and day out without peaks or depressions in labor, but more important still it makes possible an accurate control of materials, so that stores and material inventories may be maintained at the lowest possible figure. From a painstaking study of figures accumulated over many months, it has been possible to set up standard material and labor sheets for all overhaul operations on every type of airplane owned by the company. For example, for Kingbird, Condor, or Mailwing, there has been worked out a standard schedule of materials and labor for a complete re-covering job. The schedules show not only the number of square feet of fabric required for wing surfaces, ailerons, elevators, rudder, fin or stabilizer, but also the number of yards of serving tape, thread, lacing, etc. The average labor time in man-hours is also indicated for each operation. Similar sheets have been worked out for all other operations on either airplanes or engines, making it possible to predict in advance exactly how much material and labor are going to be required for any particular job.

The system in practice

With the airplane overhaul schedule laid down well in advance, and with the standard materials and labor sheets at hand, it is a relatively simple matter to control the purchasing and storing of material. Knowing definitely what ships and engines are coming through overhaul in any given period, the purchasing department can predict accurately what materials are going to be required, and is able to have them on hand on or before the date specified. To be sure, there are numbers of small items which must be kept on hand at all times for shop use but, by exercising control through engineering planning of the larger quantities of special material, it has been possible to work out very material savings in the stockroom inventory. During the year following the installation of this system, the stock inventory at the Atlanta Depot has been reduced to about 25 per cent of its previous valuation, in spite of the fact that during the same time the shops were actually handling from two to three times the former volume of work.



In practice, the system functions somewhat as follows: Assuming that the chief engineer plans to bring one Condor and one Mailwing into the Atlanta shops for overhaul during the following month, he immediately makes out a work order for each airplane, sending copies to the accounting department and to the purchasing agent. The latter consults his standard material list for the type involved, and checks his stockroom record for the amount which he has on hand. Making allowances for work which will probably be done in the interval before the particular ships involved come into the shops, he determines exactly what he must order and the date on which it must be on hand, and places the necessary requisitions. The incoming material is identified through the order number, and before being placed on the stockroom shelves it is tagged for the particular job for which it is to be used and held until requisitioned by the shops. As the jobs progress all material requisitions are turned in daily to the accounting department, together with the labor time cards. All material and labor is posted for each job the first thing in the morning for the preceding day, so that by 11 o'clock of each day the chief engineer may see at a glance the exact progress of all overhaul work in the shops. All records are posted on the original work order which, when the job is completed, forms an exact record of the cost and time involved in the overhaul of any particular unit. Such work orders form the basis for the revision of old, or the establishment of new standard sheets.

Schedules and control

The proper scheduling and control of maintenance is not an altogether simple matter when one considers the extent of Eastern Air Transport operations, and the diversity of the equipment in use. Although the main executive offices of the company are located in Brooklyn, the center of operations and maintenance is at the Atlanta Depot. Atlanta is at the apex of a rather broad and somewhat distorted "A"-shaped network of routes, one leg of which extends northeast to Newark by way of Richmond and Washington and the other southeast to Miami by way of Jacksonville and Daytona Beach. The coastal route connecting Richmond and Jacksonville by way of Charleston and Savannah, forms the crossbar of the "A." A short feeder line across the Florida Peninsula connects St. Petersburg with Daytona. Mail, express and passenger service is maintained over these routes.

Eastern Air Transport, Inc., is a division of North American Aviation, Inc., under the presidency of Capt. Thomas B. Doe. The responsibility for the detailed management of the line rests with Harold A. Elliott, vice-president and general manager, whose headquarters are in the Brooklyn offices of the company. Charles H. Dolan, based at Atlanta, functions as operations manager under Mr. Elliott, and has direct supervision over all flying and maintenance personnel and equipment. Ralph G. Lockwood, chief engineer, is also stationed at the Atlanta Depot. He is responsible not only for the co-ordination and standardization of maintenance methods, but also for general engineering development connected with new flying or ground equipment. All inspection of planes and engines, both at the Atlanta Depot and at the outlying servicing stations is organized as a separate function under Mr. Lockwood's supervision. Inspection is thus an independent check on the condition of the flying equipment.

The present passenger-carrying equipment of Eastern Air Transport includes six 18-passenger Curtiss Condors powered with Conqueror engines, one 5-AT Ford and thirteen Curtiss Kingbirds with two Wright J-6 engines each. For carrying mail only, Pitcairn Mailwings are standard. The present Mailwing inventory consists of four PA-5's, four PA-6's (reserve only), fifteen PA-7's, and five PA-8's. The power plant inventory, including engines both in active and reserve services, consists of 22 Wright J-5's, 43 Wright J-6's, 20 Curtiss Conquerors, and 4 Pratt & Whitney Wasps. As pointed out in a previous article, ("Grooming an Air Fleet"—AVIATION, November, 1931) all airplanes and engines on Eastern Air Transport are inspected and serviced on a 25, 50, 75 and 100-hour schedule. Carefully thought out forms, backed up by a detailed instruction manual covering the care of all types of equipment, have been developed to serve as a check and a control on all maintenance operations.

Until recently it has been the practice to overhaul and service all Condors and Conquerors at the Newark station. The airplanes were handled in the company shops, but the engines were sent to the Paterson plant of the Wright Aeronautical Corporation for overhaul. In line with the modern trend of airlines to concentrate all their maintenance functions at one point, the Atlanta station has been expanded to take care of all overhaul work formerly done at Newark and Paterson. Schedules have been so arranged that all flying equipment passes through the Atlanta Depot periodically for servicing and overhaul. The Newark station, in common with Richmond, Jacksonville, and Miami, is now used only for line servicing or emergency repair operations.

Atlanta expansions

The continuous process of concentration on Atlanta has made necessary two or three major expansions of the plant at that point. The nucleus of the present Atlanta Depot was completed in the latter part of 1930, and consisted of the hangar, the passenger waiting-room and ticket offices, and a small group of operations offices. A one-story building which backed up the hangar housed the stockroom and a small engine overhaul shop. A smaller detached building accommodated a work shop, a dope and paint room, and a welding shop. Within a very short time it became apparent that these quarters were inadequate, and by the summer of 1931 the first major expansion had been completed. A new engine shop was built by extending the hangar lean-to northward some 60 ft., and the necessary additional office space was obtained by adding a second story to that portion of the lean-to directly behind the hangar. Within a year, however, the increasing demand for passenger schedules, coupled with the decision to concentrate all maintenance at Atlanta, made a second major expansion program inevitable. Construction was begun in the late spring of 1932 on additional buildings, which have been completed and are now being occupied at the time of this writing. With the completion of the present program, the company now has overhaul facilities at Atlanta adequate to take care of all present equipment and with considerable capacity to take care of the probable increases in equipment in the immediate future.

Plant layout

Little need be said about the actual layout as the floor plan appearing herewith gives an excellent idea of the relationship of the various departments. Credit should go to both the operations and engineering departments for their foresight in laying down a plant that could be expanded as required into the efficient units now set up at Atlanta. It is not uncommon to find that plants which have been expanded in this fashion show a steady decrease in over-all efficiency. In spite of the fact that the present E.A.T. plant was evolved by adding to the original units at various times, the proper relationship of departments and the sequence of operations have been carefully preserved.

Present shop schedules call for the overhaul of J-6 and Conqueror engines at 350 hour intervals. All airplanes are due for overhaul at 1,500-hour intervals. Present schedules call for three radials and one Conqueror a week, but the limiting capacity of the shop is about two engines per day. All radial engines (nine cylinders) average 143 man-hours per overhaul, including eight hours of run-in, and the Conquerors require appproximately 260 man-hours, including the same run-in time. Airplane overhaul time varies, of course, with the type of equipment involved, but averages one week for Mailwings, two for Kingbirds, and four or five for Condors.

THE UNITED STATES OF AMERICA (PART FOUR)

The equipment of air forces

By
Edward P. Warner
Editor of AVIATION

PATROL aviation in the United States Navy is, as they say of steel in Wall Street, either prince or pauper. Before we entered the War it scarcely existed. In 1917, it became the mainstay of our operations. To pursue the maritime metaphor, the flying boat on patrol service was not only the mainstay, but the kedge anchor by which aviation was pulled into the forefront of Naval activities and into the focus of the Admirals' attention. After the War, flying boat development became the first victim of governmental economy, and lapsed into lowly estate. It was the subject of official experiments, and nothing more. Only since 1927 has it really begun to come back.

In the summer of 1918 patrol aviation meant two things. It meant taking a share in the anti-submarine campaign in the North Sea and off the coasts of Ireland and of France. It meant also the operation of a great number of air stations along the Atlantic Coast of the United States, principally for the advanced training of pilots who might later go abroad and for the good moral effect on the American people. There were a dozen or more such stations and the flying boats attached to them were kept ceaselessly busy scanning coastal waters from Penobscot Bay to the Straits of Florida. The Churchill Street and Elmwood Avenue plants of the Curtiss Company in Buffalo poured out an endless stream of single-engined HS 2's and twin engined H-16's and F5L's. When the output of the Curtiss planes seemed inadequate the Naval Aircraft Factory was built to supplement them, and a total of 1,611 boats was produced before the War contracts were closed. Three hundred and eighty eight of them went to Europe. As a supplement to their numbers we made use of a small number of English-built and a large number of Italian and French-built boats of various types, and the American personnel came back from Europe with quite a diverse experience in patrol equipment. Their experience in patrol operations was less exhaustive, for the function of the flying boat during the War was concentrated almost entirely upon the bombing of submarines with bombs of not over 250-lb. weight. The role of long-distance scouting, as an auxiliary to a fleet on the high seas or as a defensive measure to warn against the approach of an enemy fleet to important ports or naval bases or other

In early post-war years. Above right: One of the famous NC Class in flight. Above: An HS2L boat running on the step. Left: The long remembered F-5-L patrol boat

critical areas had had little attention during the War. In the later incarnation of patrol activity, high sea scouting has been the major object in mind.

The Navy ended the War loaded down with H-S's and F5L's as the Army was with DH4's. They were a positive burden, and any pretext was adopted to reduce their numbers. Some of them were scrapped, and some were sold to civilians. Still there were plenty left to carry on with, and in the first post-war attempt to get aviation worked into the fleet, and in the first cruises down to Guantanamo and the aircraft operations in the Carribean, the twin-engined flying boats were the main reliance. Not until catapults had begun to be installed in the fleet in some numbers, and until the UO1's had begun to go to sea with the battleships for regular gun-fire spotting service, did the

F5L yield its place of primacy in the Naval air organization

If the War had gone on another year there would have been something new to show in patrol equipment. The NC boats, far exceeding any of their predecessors in size, with a gross weight of 29,000 lb. and four Liberties, had been designed in 1918 for the object of developing patrol craft that could go abroad on their own wings and so reduce the load that aviation was throwing on transport shipping. First proposed by Admiral D. W. Taylor, then chief of the Bureau of Construction and Repair and now vice-chairman of the National Advisory Committee for Aeronautics, design and construction were carried out by a co-operation of the Navy Department, and especially of Commanders G. C. Westervelt, H. C. Richardson, J. C. Hunsaker and the Curtiss Company. The first of the NC type was completed just prior to the armistice, and the subsequent flight from New York to Plymouth, England, by way of Newfoundland the Azores, and Portugal, the first crossing of the Atlantic by air, is too well remembered to need recounting.

The years between. Above: The PN-9 used by Cmdr. Rodgers in his attempt to reach Hawaii. Right: The twin-engined Douglas PD-1

We can pass lightly over the next few years, for there was nothing to record except the gradual disappearance of the war-time boats. On July 1, 1921 the Navy had had 625 of them. At the end of 1925, the number had fallen to 109. At the end of 1927 it was down to 53, as against 116 called for under the five-year plan, and the patrol situation was becoming desperate.

The aircraft industry had rushed its hands of flying boats in 1919. Aeromarine and Boeing built some commercial boats, but the industry was inactive in the naval field, with the exception of a single ship until 1927. The one exception was the Boeing PB1, a huge craft of nearly 30,000-lb. gross weight, originally built with two 800-hp. water-cooled engines in tandem. An attempt to switch to air-cooled engines of much lower power left the machine overloaded, and retirement to an experimental status ensued.

In the meantime although the industry had been turning a deaf ear to claims of the flying boat, the Naval Aircraft Factory had been busy. The first of the PN series appeared in 1923, and almost immediately began to make world's records.

There is not a great deal to be said about the PN's. On the whole, they were the natural outgrowth of the F5L. The PN-7, first of the line differed from the war-time type in having a somewhat thicker wing section and a simpler truss, with two water-cooled Wright engines in place of the war-time Liberties, and celebrated its own advent by flying for 5½ hours with a "dead," or contest load of 2,200 lb., and establishing a new seaplane speed record" under the same conditions of 78 m.p.h.

There followed a succession of PN's of various shapes, all externally braced biplanes. Most of the series had hull lines of the F5L type with two steps, but the PN11's and the later XP4N's were based on the hull design of the NC class, with the hull run back to support the tail instead of leaving it to be carried on booms. With the PN-9, the change from a wooden to an all-duralumin hull was made,—a vogue that had first been established by one of the Aero-marine commercial designs. The PN-9, of course, lives in history particularly as the vehicle of the barely unsuccessful attempt of Capt. John Rodgers to reach the Hawaiian Islands in flight from San Francisco. Though the 1925 flying boat fell short by only a hundred miles on that flight and though the trip has since been made by five landplanes, no flying boat has renewed the attempt in the last seven years.

That the industry had been inactive all this time was through no inherent antagonism to flying boats. The Navy simply didn't have the money to spend. With only $2,000,000 a year for all experimental and development work, it seemed hardly possible to vote $200,000 or more to a single example of a single type of flying boat, especially when it was recognized that if the machine proved satisfactory subsequent examples would cost close to $100,000 apiece. Although aviation personnel talked from time to time of building giant flying boats which could be operated as separate units, with a single boat serving as the equivalent of a destroyer, the money was never available. The study of the giant boat has just recently been taken up again, and Admiral Moffett told the 1932 convention of the N.A.A. of a plan for a naval flying boat of some 50-tons weight.

In 1927 the Navy Department began a definite effort to stimulate the interest of American constructors in the flying boat, not only for Naval but for commercial purposes. Not long thereafter, bids were invited on the construction of 25 boats essentially identical with the PN-12. The competition for the order was hot, the choice fell on Douglas, and the Douglas boats designated as PD-1, have until very recently constituted the major part of the patrol squadrons' equipment.

At the same time the decision was finally taken to go ahead in spite of the great expenditure required, and develop experimental boats of fundamentally new types. Germany, Italy and Great Britain were obviously getting ahead of the United States in the variety of good new patrol designs available, if not in the absolute quality of the best among them. The monoplane had gained unquestioned leadership in Germany and in Italy, and it was the subject of new interest and experiment in Great Britain. The American Navy decided to try out a monoplane, and invited tenders from the industry. Consolidated got the order.

The original plan for the Consolidated PY-1 had called for three 300-hp. Whirlwind engines. The new Whirlwind was not available quite as soon as had been expected, however, and for that and other reasons the design was changed to use two Wasps. The change in make was unimportant except to the manufacturers concerned, but the change from three engines to two was a major departure.

The persistent popularity of twin-engined flying boats is somewhat surprising. Most of them, like many twin-engined military landplanes, unable to fly and to continue normal flight with a full load and one engine dead. In the case of a landplane, the surviving engine will at least serve to stretch the glide over a particularly bad area and to increase the range within which a landing field can be sought, but when a flying boat is over the open sea all landing places for a hundred miles or more are likely to be equally bad, and stretching the glide is of no particular service. Furthermore, it is usually impossible to taxi a twin-engined boat in a straight line on one engine alone. Everything seems to be in favor of the three-engined arrangement, yet the war-time tradition, which developed simply because military requirements demanded a boat of about 800 hp. and the largest engine available had only 400, continued to rule until 1928. The British were the first to break away from it. We were very slow indeed, for we had no three-engined flying boats in the American service until the PY-1 was revised and tried out with three Wasps in place of the original two. No three-engined type has yet gone into service.

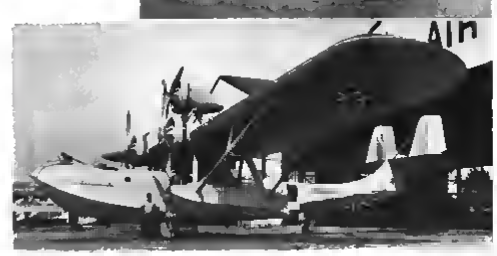
By the spring of 1928, Consolidated and Douglas were well established in the flying boat field. Martin was the next to arrive there. The Martin Company's reputation had been made on bombers, and Glenn Martin had determined to establish himself as a leading builder of big airplanes, whether they based on the land or on the sea. Martin boats have gone into five types and about 70 individual machines. Most of them have been twin-engined biplanes, again based on the PN series as supplemented by the Martin Company's own development. After the first Consolidated boat was tried, however, the next chance to build monoplanes went to Martin, and nine boats with twin Wasps were succeeded by one, the XP2M1, much faster and heavier, with three Cyclones.

The only other company among the large producers that has gone into flying boat work is Keystone. Their interest was naturally enough aroused by propinquity, for the Keystone factory is but 25 miles from the Naval Aircraft Factory. Like Douglas and Martin, Keystone has had an order for boats along PN lines.

One production order of the last four years remains unmentioned. That, with several experimental contracts, went outside the ranks of the industry regularly engaged in large-scale production of miscellaneous military types. Mr. Charles Ward Hall, famous specialist in ultra-light duralumin construction and in ultra-refined strength calculations to take account of secondary stresses, has found his method particularly well adapted to the flying boat. One of his first applications of his system of wing construction was made in a set of wings built to Navy order for an HS boat some eleven years ago. They proved to have less than half the weight of the wooden wings that they replaced, and it became inevitable that Mr. Hall would some day construct his own flying boat, incorporating his own ideas from stem to stern. The principles of engineering developed by Mr. Hall have so far been applied almost exclusively to biplanes, and nine twin-engined ships have been delivered during the last few months. An experimental biplane boat of much larger size is still under construction. Sikorsky, too, is going ahead with an experimental patrol project.

At the end of last year, the Navy had flying boats on hand to fill more than two-thirds of the complement of its five-year program, but most of them still showed plenty of direct inheritance from the war-time types. They totaled 99, of which number 90 were twin-engined biplanes, with two-step hulls obviously deriving directly from the work done by Commanders Richardson and McEntee and other Naval officers during and before the War and from British war-time types. The characteristic American hull, until recently, has had a spoon-shaped bow and relatively flat sections forward, as opposed to the ship's lines, with a bow very sharp in transverse form and with sharp V sections forward, of the Rohrbach and other continental boats, and of the NC (which broke with the old tradition, but failed to get a new one accepted). The monoplanes built by Martin and Consolidated as well as the Douglas Dolphin amphibion and the Hall biplanes, show a marked tendency toward sharpening of the bow and the adoption of the lines of a high-speed surface craft.

Of the 99 boats on hand in December 64 were the product of the Martin factory. Of the 41 on order 23 are Consolidated monoplanes, the P2Y1 with two Cyclone engines.



Patrol boats of 1932. Above: The Consolidated XPY-1 at Anacostia. Left: All-aluminum—the Hall XPH-1 in flight. Below, left: Pyramided power plants—the Martin XP2M-1

Flying-boat construction still runs into plenty of money, though the costs are not as high as it was feared they might be when work on the type was starting. The new Consolidated ships will cost about $80,000 apiece complete with engines. In terms of gross weight, however a total cost of about $4 per pound makes them among the cheapest of all naval aircraft.

Obviously the future trend of flying boat development, as well as the number of boats that are to be purchased, will depend on general naval policy. During the War there was a specific problem of

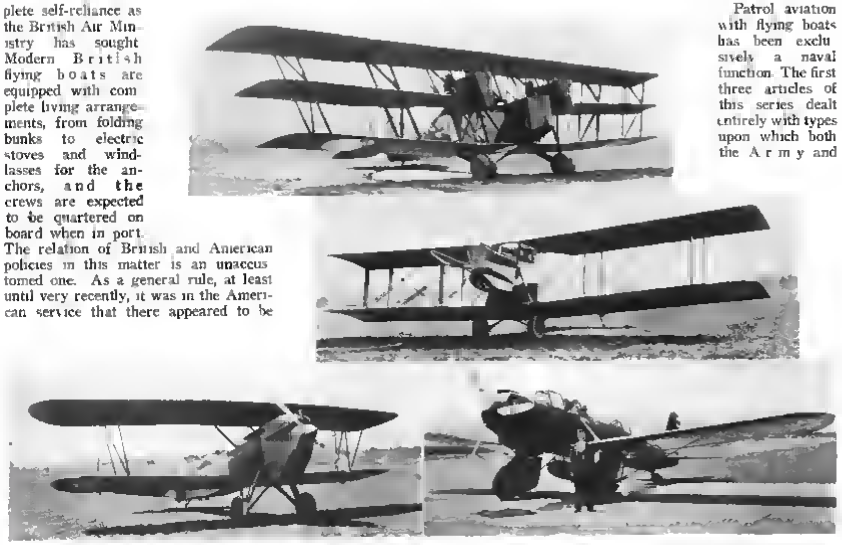
securing a reasonably long range and the ability to carry at least two bombs heavy enough for attacking submarines Speed was of almost no importaoce Toward the end of the War, the Navy Department saw those requirements as supplemented by a need for very long rangr, so that the ships might be delivered across the Atlantic and under their own power Hence the NC Since 1919, the center of gravity of our naval interests has turned from the Atlantic to the Pacific, and the ability to command the vast reaches of the Pacific, or at least to get from one restingplace to another in that ocean, has become a fundamental aim From San Francisco to Honolulu is 2 420 statute miles Roughly speaking, and allowing for the necessity of traveling in either direction, either with or against the prevailing trade winds, a patrol boat must have a normal range of some 3,000 miles in order to operate freely in the Eastern Pacific It hasn't yet been attained, but it certainly isn't beyond the reach of possibility The importance of long range was first stressed in the NC It is bound to receive much more stress in the near future

Perhaps because extreme range in flying boats is of relatively more importance In the American Navy than in the Royal Air Force, American designers have been allowed to economize on weight by not having to conform to any such elaborate specifications for complete self-reliance as the British Air Ministry has sought Modern British flying boats are equipped with complete living arrangements, from folding bunks to electric stoves and windlasses for the anchors, and the crews are expected to be quartered on board when in port The relation of British and American policies in this matter is an unaccustomed one. As a general rule, at least until very recently, it was in the American service that there appeared to be comparative indifference to the weight of aircraft and a willingness to make substantial sacrifices in performance in order to get extreme ruggedness and complete military paraphernalia.

There is an obvious alternative to the development of boats of very long range in the creation of types so seaworthy that they can be landed at sea for refueling from surface craft and then take off again from the surface It is a possibility that has charmed many designers and some naval air personnel, but up to now it is far from being realized There is plenty of evidence such as the safe landing of the NC-1 and NC-3 in mid-Atlantic and the ultimate arrival of the latter in port under its own power, and the experience of the PN-9 on the attempted flight to Honolulu in 1925, that good flying boats can be set down safely under ordinary high-seas conditions Really modern boats with metal hulls should be in little danger of injury in such a landing, but there is nothing whatever to indicate the prospect of being able to get off again safely Flying boats operate from sheltered bays, or from exceptionally smooth areas at sea In the tradewind zones of the Caribbean and the Pacific, where the seas endlessly run some 10 ft from trough to crest, and the wind endlessly blows 20 miles an hour, no flying boat will take off unless it be something very different indeed from the present types Long before the take-off speed is reached, the plane will be catapulting off the crest of each swell to land with a shattering crash in the next trough German designers claimed some years ago to have solved the problem, and indeed some of the big German boats have appeared to operate very successfully in the North Sea without using sheltered roadsteads Even there, however, there has been plenty of trouble, and conditions in the North Sea are by no means as severe as those in the Pacific. For general naval service the flying boat must operate from harbor to harbor or at the very least into the lee of a sheltering island or coral reef, without intermediate landing

Although there is as yet no evident American trend toward three-engined flying boats, the writer feels some confidence that the Navy's future choice will swing in that direction As between monoplane and biplane it is hard to predict the future, but the monoplane, with all its aerodynamic structures far above the sea, should be inherently a more seaworthy type It seems likely that we shall see more monoplanes in future, and that they will be made with thicker wings and less external bracing than in the past, permitting some reduction in span and the housing of the engines largely within the wing as recommended by the National Advisory Committee in the light of its nacelle researches in the 20-ft tunnel

Patrol aviation with flying boats has been exclusively a naval function The first three articles of this series dealt entirely with types upon which both the Army and



Evolution of the attack plane. At top: The "flying fortress"—the famous GAX of 1922. Above, right: An experimental "aerial tank"—the GA-2. At bottom, left: The familiar Curtiss A-3B attack ship. At bottom, right: Out of Tweaker by Curtiss—the YA-8.

the Navy are active. Now we come to the last of the service types—a type outside the scope of the Navy's official recognition,—the attack plane

Attack

Attack aviation was more or less incidental during the War Attacks on ground forces were made as a measure of opportunity, by pilots whose inclination ran that way and in whatever equipment they happened to be flying at the moment. There was no formal organization of attack units, and only two attempts to develop special ground attack planes,—the British Sopwith Salamander, and the Junkers "Flying Tank."

Both the Junkers and the Sopwith showed a fundamental idea which persisted when the American Army Air Service returned from France and launched its plans for post war development of the attack function The scheme was to make it possible for the plane to fly with impunity at low altitudes over an enemy's trench lines The name of "Flying Tank" speaks for itself So to anyone acquainted with zoological myth does the name of Salamander Both planes had their vital parts armored with the presumption that they could turn aside rifle or machine gun fire If asked what was to happen when they met up with an armor-piercing bullet or a burst of high explosive, the designers would have had to reply, as a commercial pilot once said to me when I asked him what would happen if one engine were to cut out on the take-off on a tri motor which he was operating from a field where he had to go out directly over high tension wires with almost nothing to spare: "We try not to think of that."

American attack aviation has gone through two eras—the armored and the unarmored The armored period began immediately after the War and lasted until 1923, by which time fifteen machines had been built, one "ground pursuit," two single-engined ships of much larger size mounting from four to six machine guns in the bottom of the fuselage, and eleven still larger twin Liberty-engined tri-planes known as the GAX, with a total of ten guns and armor all over everywhere. The epitaph of the aerial tank was written when the extremely competent and extremely candid test pilot who presided over its trials included in his report the sinister observation: "It is not anticipated that this airplane would ever return from its first trip over the lines." It was evident that the attempt to provide armor protection created a hopeless dilemma In order to be effective against even the lightest fire, the armor must be so heavy that the resultant sacrifice in speed and maneuverability would be so great that the machine plodding steadily along the trench lines would become an easy mark for artillery

The second era of attack aviation began about 1926 It began with a recognition that the greatest safety for the ground attack pilot lay not in putting on a bullet-proof vest and then sticking around to be shot at, but in disappearing over the horizon before anybody had had the time to begin shooting, or in changing course and location so rapidly that a gun couldn't be sighted on him The A-3 appeared as a modification of the Curtiss Falcon, an observation type made into an attack plane by mounting two guns to fire forward through the propeller and supplementing them with two more buried in the lower wing and firing forward and downward at a fixed angle to rake the ground, plus one movable gun in the rear cockpit

Attack as a wholly distinct function, inviting the development of a type new from the ground up, returned in 1930 Its return was almost simultaneous with the development of a new shool of thought which called for all-metal monoplanes with monocoque fuselages in all Air Corps service The Curtiss XA-8 with the conqueror engine was a pioneer example of the new doctrine in attack service The XA-8, familiarly known as "Tanagerized" in memory of the machine that won the Guggenheim Fund safety competition, is also the first American service airplane with slots and flaps. The ship has passed through the experimental stage, and thirteen are now under construction for service tests

It seems to be established that the two-seater monoplane such as the Curtiss A-8 with four or six guns and the ability to carry a load of fragmentation bombs and a speed of close to 200 m.p.h., is to be the attack plane of the immediate future There is no reason to anticipate a change in recent trends in that respect Whether the monoplane will be low wing or high-wing is not so clear At first sight the high wing type appears to have a special advantage in the improved vision of the ground, but as a matter of fact, the advantage, leaving all questions of aerodynamics and structure aside, is probably on the other side. The attack pilot is interested only in where he is going next, not in where he has just been His fire is always directed ahead, and his vision should follow the same path

Attack planes have been discussed here as a purely Army type The name is used only in the Air Corps, but the function is not unknown to another branch of the service. The work that the Marines had to do in Haiti in 1924 and thereabouts, and in Nicaragua for the past five years, has been attack aviation in all but name It has been characterized, however, by a complete absence of artillery fire from the ground Only fire with ordinary rifle ammunition has had to be feared, and under those circumstances a limited application of armor has again begun to have some interest It has been carried only to the length of fitting a piece of steel plate under the pilot's seat, and that only in a few instances. The machines have been standard Vought Corsair and Curtiss Falcon and Helldiver observation types, with the regular installation of guns firing through the propeller, and the guns have been brought to bear on the ground by switch-backing violently, repeatedly diving to fire and zooming to gain altitude.

•

The Aeroplane Speaks

IT IS always interesting to know what our foreign contemporaries think of ourselves and our accomplishments They are never likely to be unduly flattering to the products of American industry which compete with their own, and it is most gratifying to encounter such an article as recently appeared in *The Aeroplane* (British), entitled "Mobile Comfort," describing the Model R Stinson

F D Bradbrooke, airplane critic of the British magazine, was obviously much impressed with this machine The following sentences are quoted from his remarks:

"The first impression one gets from the machine is that we in Europe have too long cherished the assumption that people are willing to be uncomfortable in aeroplanes An old war-pilot, on his first aerial journey for twelve years, remarked to me not long ago that flying is just as noisy and draughty as ever That is not true of our cabin types, but we have not gone as far in the direction of saloon [British for limousine] comfort as this latest Stinson product."

"The outside finish is astonishing, as I have remarked before about the earlier Stinson Junior. The fabric can hardly be distinguished from metal by eye alone The lower stub wing is a handy platform for maintenance crews."

"Perhaps the most striking thing about the whole aeroplane is the quiet way in which the engine starts up from cold when the appropriate button on the instrument board is pressed."

In a supplementary paragraph C G Grey, although criticizing the machine on a performance basis, states

"As for this aeroplane, I recommend every designer in this country to go and look at the cabin, to see what such a thing ought to be. It is as far ahead of us as the equipment of American cars in 1920 was ahead of us."

EDITORIALS

AVIATION

EDWARD P. WARNER, *Editor*

Make this a precedent!

SEPTEMBER 12, 1932. Mark it in red upon the calendar. Upon that day the four leading domestic airlines in the United States in point of mileage flown pooled their efforts and addressed themselves to the people of America's largest city with a single voice. For one evening they forgot that they were to some degree in competition, and abandoned their efforts to take passengers away from each other. They joined forces for one concentrated push. They brought together at the Newark Airport 500 of the leaders of financial, industrial, political, and social New York. They took three hundred of them for night flights over the city as guests of the management, and the object of it all was not to convert the guests of the evening to any particular airline, nor to impress the virtues of any trademark upon their minds, but to convince them that all established airlines are good and that a passenger can take air travel as a matter of course, as he would take railroad travel, without any preliminary personal investigation of the competence of the pilot or the structural safety of the plane.

Joint effort of this sort is not, of course, unprecedented. A group of lines in California operated a joint selling campaign from the platform and the broadcasting studio a number of months ago. On no previous occasion, however, had there been such dramatic evidence of the triumph of the co-operative spirit and of the disappearance of the old and evil ways.

For non-co-operation was no monopoly of Mahatma Gandhi's. AVIATION has had its share.

Once upon a time a representative of AVIATION expressed regret to a certain airline official (since retired) that the magazine had not developed a larger circulation in one of the company's shops. The gentleman's reply was a classic. It left nothing to the imagination. "I don't want my men to read trade periodicals," he said, "because if they start reading about how other people do things in other shops they will get confused. There is only one right way and that's the way we do it, and I don't want them to know about anything else."

That episode couldn't be repeated anywhere now. Even now, however, one finds occasional evidences of over-enthusiastic traffic promotion men suggesting that "*our* airline is, of course, safe and sure and comfortable and pleasant, but you never know about the others." Air travel has no place in it for that sort of sales promotion.

The Newark adventure ought to be a precedent, and we believe it will. This same sort of collective campaign ought to be undertaken in Chicago and St. Louis and Kansas City and Los Angeles. It should be backed by collective mail campaigns and advertising drives. A great deal of very intelligent traffic promotion work has been done by American airlines in the last three years. Money has been wisely and profitably expended on advertising, and immense ingenuity has gone into the development of spectacular stunts to dramatize the extraordinary value of air transport to the business community and the extraordinary completeness of the safeguards with which it is surrounded. It is safe to say, however, that where three or four companies have been engaged in such work on their own account the results would have been at least 50 per cent better if they had all been working together under a common guidance. The meeting at Newark has shown the way to results. Now it is up to the operators to carry on along the new line with constantly increasing vigor, and their goal should be to find two million passengers for American air transport lines in the year 1935.

First aid for foreign trade

IF an inquiring reporter were to descend upon a gathering of the aircraft industry and say "Department of Commerce" to the first ten people that came along, nine of them would take it for granted that he was talking about the Aeronautics Branch. The tenth might remember that the huge organization that has just taken over the largest office-building in the world has other functions than those of licensing of aircraft and pilots and airway development. He might even recall that the department contains a Bureau of Foreign and Domestic Commerce, that the Bureau contains an Aeronautics Trade Division, and that the division contains Leighton W. Rogers, Fowler W. Barker, Brower E. York, Laurence Ring, and sundry coworkers.

The Aeronautics Trade Division may go through the year unhonored and unsung, but the would-be exporter of aeronautical products quickly learns to rely on it. What is the tariff on airplane propellers in Latvia? Ask the Aeronautics Trade Division. Who is the officer in charge of specifying the qualities of military planes for the Bolivian air force? Ask the Aeronautics Trade Division. How should wings be packed to withstand the rigors of shipment to Siam? Ask the Aeronautics Trade Division. What kind of airports do they have in Persia? Ask the Aeronautics Trade Division. And if you can think up any more questions, ask them those, too.

In 1928 only 5 per cent of the products of the American aircraft industry went abroad. For the first six months of 1932 the percentage was approximately 9.2. The improved export situation must have increased the net profits of American firms in the past year by at least $400,000, as compared with what they would have been if the 1928 ratio had maintained. Hard work by the manufacturers' own sales departments had a good deal to do with the improvement, but a large share of the credit must go to the Aeronautics Trade Division. It is time for them to be dragged from the modest shade in which they customarily dwell and given a blast of well-deserved limelight.

A guidepost to higher speeds

ROUGHLY speaking, 80 per cent of America's airline operators are agreed that the transport airplane of the comparatively near future ought to cruise at somewhere between 180 and 250 miles an hour. How can their demands be met without undue sacrifice elsewhere?

There are only three basic ways of increasing maximum flight speed. Every single change that can be made to affect it comes under the head of

(1) Increased aerodynamic efficiency, (2) Increased wing loading, or (3) Increased power loading.

We can classify further. If the wing loading is increased, we must either (2a) Use slots or some other variable-lift devices, or (2b) Accept an increased landing speed. In either case the ceiling and rate of climb are apt to be diminished. We can reduce the power loading either by (3a) Decreasing the payload per horsepower, or (3b) Improving the structure and so reducing its weight, or (3c) Cutting down the power plant weight for a given power output.

Aerodynamic efficiency at maximum speed is now as high on the best transport planes as on any military or racing machines that have ever been built. The ultimate record is in fact held by an American commercial transport, which shows a basic efficiency coefficient about 3 per cent better than that of the last winner of the Schneider Race. To increase the landing speed, even if the Department of Commerce can be persuaded to relax its restrictions on that point, is questionable practice on planes that must fly over bad country and operate from fields at very high altitudes. At most we can hardly look forward to tolerating an increase of more than 50 per cent, which would bring landing speeds up from their present 65 m.p.h. to 80 m.p.h. Slots and other variable-lift devices hold out a great deal of promise, but even with those it seems scarcely probable that wing loading can be stepped up by much more than the 50 per cent just suggested. At least, the possibility of doing so will depend on a general availability of 4,000-ft. runways with clear approaches.

There remains the possibility of reduced power loading, and it is upon that that we must fall back if we are to secure an increase of cruising speed of more than about 15 per cent over present levels while keeping to anything like the present general type of airplane. If we really determined to have a cruising speed of 200 m.p.h., lb.-per-hp. is the pass word.

Naturally it is undesirable to cut payload, which has already dropped from a typical level of 4 lb. per hp. to a typical 2.5 in the last five years. Better structures are certainly to be expected, but barring wholly radical invention such as has not been seen in the last dozen years that, too, is likely to show a gain in speed of but 2 or 3 per cent. So at last we are cornered. We are left with only one way to turn, and we go where the airplane designer has often been driven in his final recourse, to an appeal that we be given more power out of the same engine.

We come to petition the engine designer for help, and we have specific grounds on which to base our plea. Three years ago a standard American radial engine in the 1,300-cu. in. class was rated at 400 hp., and nothing more was expected of it. Today essentially the same engine, with the same piston displacement and over-all dimensions, is producing 500 hp. or better from one year's end to the next, and in Cleveland the same engine with minor modifications in the supercharging segment of its anatomy produced approximately 750 hp. without apparent difficulty. Take a 400-hp. power plant out of a transport ship and put in one of the same dimensions and weight that gives 750 hp., and the total payload can be increased a third, the wing area increased enough to keep the landing speed constant, and the maximum speed will go up some 20 m.p.h. Whatever else may be done, it is plain that if we want cruising speeds up to 200 m.p.h. on commercial planes in company with a decent measure of economy, we shall have to push the power of our radial engines up to at

least 0 5 hp for every cu in of displacement. It has already been done on the race course. It is reasonable to expect that it can be done on the airlines.

It is only five or six years since there were plenty of operators, both in the military service and in civil life, who would argue that every engine must run on domestic aviation gasoline (if not actually on automobile or motor-boat gasoline) and that nothing else could be considered. We have progressed to the point where special fuels on the airlines are habitual and where sea-level supercharging is recognized as a measure of economy, even though it require a fuel costing 2 or 3 cents more per gallon than the cheapest that might be obtained for an unsupercharged power plant. An anti-knock rating of 80 on the octane scale is commonplace now, and even higher ratings are gaining ground, but if we want higher cruising speeds we must go farther still. There is much to be said for high-grade fuels and high compression ratios and sea-level supercharging in any case, but if we are to have superlative cruising speeds those refinements are absolutely essential.

Airport rating

THERE are 1,153 municipal and commercial airports in the United States. The Department of Commerce says so. They have all been tabulated and their characteristics listed with admirable detail. The pilot who wants to go by air to Siwash Junction can look it up in the book and find five or six lines devoted to describing its landing areas, its servicing facilities, its transportation, and the like. Nowhere, however, can he find any simple index of the general qualities of the field, nor any code number which will at a glance give him a general idea of how it compares in provision for his needs with other fields that he has seen. In short, airport ratings, to which the personnel of the Aeronautics Branch have devoted a great deal of careful thought, have proved to be a sorry jest.

There are, as already noted, 1,153 airports in the United States. As of Sept. 1 only eighteen of them, or 1.6 per cent, have been given a rating. It is such a novelty to encounter a port with a rating attached to it that one hardly ever thinks of looking for such a thing in collecting information on a new field. For one of the major purposes that it was designed to fulfill,—the giving of quick, easy, and general information to the pilot,—the rating system has proved practically useless.

The reason is easy to find. The first ratings that were given were A1A. Ratings were optional, and it seemed better to have no rating at all than to have anything below 100 per cent. The cities that discovered that they couldn't equal the best of their neighbors and get the A1A mark on their field quietly withdrew their applications for listing. Now that the Department has created a new and even higher standard, the ATA, the result is likely to be an even greater restriction of the number of ratings sought, for most of the cities that can't get the "T" listing will refuse to take anything at all. Rating, except for a very few of the largest cities, will become even more futile than it is at present.

The present system of rating only upon request from the airport operator has been given a long enough trial to prove that it will not work. The time is ripe for a change, and the obvious change is to make the listing compulsory instead of optional. The Department of Commerce has enough data in hand on every airport, thanks to the regular submissions of questionnaires and to the travels of Department inspectors, to give at least an approximate rating. We suggest that it be announced that on April 1, 1933, a rating will be assigned to all airports which have not regularly applied for one, and that in making such assignment any points upon which there is uncertainty or inadequate information will be resolved against the airports, or that airports which have not submitted proper questionnaires will automatically be given the D4X rating. There will be no difficulty then about securing the co-operation of operators in furnishing all the available data to get the best rating possible, even though it may be far short of the ATA standard. We strongly recommend that that course be followed, and that the next edition of the Official Airport List include a rating for every municipal and commercial field. There would be a brief period of uncertainty in which some of the ratings would not represent true conditions, but within a few months we would have a genuine index of the quality of virtually 100 per cent of American airports, instead of 1½ per cent.

The usefulness of air navigation maps can be greatly increased, for the actual rating of each field can be shown by appropriate convention on the maps in place of the present indication limited to the vague distinction between "airports" (all of them lumped together), intermediate fields," and "auxiliary fields." Finally the new policy would offer a new and powerful incentive for the improvement of airport facilities in medium-sized cities, where improvement is often most urgently needed. A community which has, with great travail and after a long civic campaign, raised the money to buy an 80-acre airport and to put up one small hangar and a set of boundary lights, can see no hope of qualifying for an A1A, to say nothing of a "T" rating. So long as no other rating seems to count, efforts to improve the field seem scarcely worth while. Let it become apparent, however, that there is a chance of rising from the C3D grade into the B2B, and the civic spirit that built the field will be mobilized again to push the old home town one rung farther up the ladder. The first step toward generating a lot of new airport improvement enthusiasm is for the Department to make rating universal, and to publish its ratings.

NEWS OF THE MONTH

Doolittle does it

TWO attempts, one made during the solar eclipse without benefit of the barograph essential to F.A.I. convention, the other with a strong wind diagonal to the course, preceded the speed trials in which Major James H. Doolittle broke the world's land plane speed record of eight years' standing. In four laps over a three-kilometer course, the first at 309.04 m.p.h., Major Doolittle averaged 294.39 m.p.h. This exceeds by 15.91 miles, the record made by Warrant Officer Bonnett of France, at Istres, France, in 1924. Major Doolittle flew the Wasp-powered Granville racer built for Russell Boardman, world's distance record holder, whose injuries in a crash a few weeks ago prevented his piloting it himself. The special Laird biplane which Doolittle had built for the races was damaged during a test flight in a mishap through which its pilot owner came unhurt.

To his flying partner, James Haizlip goes the transcontinental speed record (with stops for refueling), which Major Doolittle had held since the National Races last year. In a ten-hour nineteen-minute flight from Los Angeles to New York, Haizlip and his black and white Wasp Junior-powered Wedell-Williams monoplane cut 56 minutes 59 seconds from the record, and incidentally captured the Bendix trophy and $10,000 in prizes. In hot pursuit across the continent came Colonel Roscoe Turner, eighteen minutes ahead of the already-beaten Doolittle record of eleven hours sixteen minutes. Turner flew a Wedell-Williams plane, as did James Wedell, co-builder of the plane, who finished the race at Cleveland.

A week after her husband's new transcontinental record flight Mrs. Mae Haizlip flew the same plane to a new world's speed record for women. In four laps for a three-kilometer course, one of them at 268.7 m.p.h., Mrs. Haizlip averaged 254.43 miles an hour, about 4.3 miles a minute.

Yet another record fell to Amelia Earhart Putnam, incidental to her proving to herself that she could fly the continent non-stop. Following the Federal Airway from Los Angeles to New York, a distance of about 2,600 miles, Miss Earhart surpassed by about 500 miles the feminine distance record held by her fellow-townswoman, Ruth Nichols. Flying her transatlantic Lockheed, with Wasp, she made the trip in nineteen hours five minutes, missing by an hour and a half the non-stop record set by Capt. Frank M. Hawks at seventeen hours, 38 minutes.

The flying Scot in new fields

Setting the wheels of his tiny Puss Moth down on a Pennfield Ridge pasture, near St. John, N. B., 30 hours and ten minutes out of Portmarnock, Irish Free State, 26-year-old James Allan Mollison, on Aug. 19, joined the select trio of solo trans-Atlantic fliers, the first person to make the westward air crossing alone. Col. Charles Lindbergh, Amelia Earhart Putnam, and Bert Hinkler, who also used a Puss Moth in his solo South Atlantic crossing, flew eastward from the new world into the old. Specially built by the De Havilland company, Mollison's silver monoplane is powered with a 120 hp Gipsy III engine and almost identical with the ships in which he established Australia-England and London-Capetown records in August, 1931, and March, 1932. One hundred and sixty-two gallons of gasoline in a tank which formed a back rest for the stool on which he sat, in another tank just in front of him, and in the standard wing tanks, were almost entirely consumed in the battle with head winds and storm. Captain Mollison re-fueled and rested before completing his flight to New York, where the plane was overhauled for the return flight. Plans for the first round-trip ocean crossing had to be abandoned because of his impaired state of health.

While the young Scot was flying the Atlantic, Prof. Auguste Piccard of Brussels University was exceeding his own record in the vertical plane. Accompanied by his assistant, Max Cosyns, the Swiss scientist travelled once again into the stratosphere to continue observations of the action of cosmic rays, begun last summer when a height of 52,500 ft. was reached. Inflated with 95,000 cu. ft. of hydrogen, the huge yellow balloon with its globular gondola rose from Duberdorf, Switzerland, to a height of 54,120 feet, coming to earth again 150 miles away near the southern extremity of Lake Garda, scene of most Italian high-speed trials. Previous to Professor Piccard's experiments the greatest height attained by man was 43,166 ft., reached by Lieut. Apollo Soucek of the U. S. Navy in an airplane on June 4, 1930.

Captain Wolfgang von Gronau, whose trans-Atlantic flights over the Northern route have become annual events, has added the north Pacific to his log. After a month's vacation in the United States, von Gronau and his three companions continued their flight to Tokyo with stops at several points in Canada and Alaska, at Attu, the last island of the Aleutian chain, and Paramushiru, northernmost of the Kuriles and 800 miles further west. Only the Army round-the-world flight and Colonel and Mrs. Lindbergh had previously flown the Aleutian-Kurile route, and only von Gronau found fair weather. The Dornier Wal was forced down but once, in the Andreanof group of the Aleutians, by bad weather. It covered in less than six hours the whole course of the Kuriles, from Paramushuru to Nemuro, where fog detained the Colonel and his wife for days.

N.A.A. convenes

In connection with Aviation Week, which also featured a celebration of the birthday of Orville Wright, who with his brother Wilbur made the first heavier than-air flight, and the start of several of the air derbies preluding the National Air Races, the Eleventh Annual Convention of the National Aeronautic Association was held in Washington. Its president, Senator Hiram Bingham, elected to the office for the fifth successive year, in his opening address presented the needs of American aviation—greater quiet and comfort in air transport, a larger reserve of civilian pilots, development of commercial airships—and the efforts of the N.A.A. to satisfy them during the past year. While none of the bills concerning aeronautics or aviation passed both houses of Congress during the past session, it is hoped that continued intelligent pressure will bring results in the near future.

Climax of the second day's session was an address by Rear Admiral William A. Moffett, chief of the Bureau of Aeronautics, who stirred the assembled members to enthusiasm with his plea for a merchant marine of the air. He discussed the advancement made by the lighter-than-air service of the Navy, especially in hooking airplanes onto the

Calendar

Sept. 25	Gordon Bennett Balloon Race Basle, Switzerland
Oct. 8-23	Aviation Exhibit, 46th Annual State Fair of Texas, Dallas.
Nov 18-Dec. 4	Thirteenth International Aeronautical Exhibition. Grand Palais Paris.

Akron and releasing them again, citing a total of 104 hook-ons made during one day's test without accident. Navy experiments with flying boats were mentioned also as of great value to commercial aviation. The Admiral expressed his intention to build, as soon as sufficient funds are available, a 100,000-lb flying boat with a speed of 160 m.p.h. and a cruising radius of 3,500 miles with full war load.

Amateurs have their day

A red letter day in the diary of many sportsmen pilots was Aug. 20, when 50 privately owned planes took off from Roosevelt Field in an International Goodwill Flight to Montreal. Flying in formation, in groups of planes of similar cruising speeds, the delegation landed at St. Hubert Airport to witness the Fourth Annual Canadian Air Pageant.

A recent innovation at the Boeing School of Aeronautics is a 1,400-mile cross-country flight from Oakland to Salt Lake City and return over the coast-to-coast airway. Under the direction of the chief flight instructor four master pilot students made the trip in September, alternating at the controls of the eight-place training transport.

As part of its regular curriculum the Brooklands School of Flying at Brooklands Aerodrome, in Surrey, England, has introduced dual instruction on the Cierva autogiro. No additional charge is made.

Successfully through days of comprehensive teochnical trials came 41 light sport planes to start on the International round-Europe flight for the Hindenburg trophy. Francisce Zwirko, Polish pilot, led the 26 contestants who finished a 4,690-mile course and a 190-mile speed race at its finale. He flew a Genet Major-powered R W D 6, Polish cross between the American Monocoupe and British Puss Moth. Flying an Argus-powered German Heinkel HE 64 Fritz Morzik, victor last year and the year before, came in second, while another German, Reinhold Poss, flew a Klemm K L 32 with an Argus engine to third place. Starting from and finishing at Tempelhof Airdrome in Berlin, the seven-day race included a crossing of the Alps, an over water hop to Sweden and stops in most of the important cities of Europe. Points were given for low fuel consumption, low landing speed, and a variety of other technical qualities. Ten days after their victory at Berlin, Zwirko and his passenger, M. Wigura, were killed in an air crash.

Airlines at a new high

Almost all the previous records of airline operation were broken during the first six months of this year. Semi-annual report by the Department of Commerce shows 24,668, 414 airplane miles, 63,529,538 passenger-miles flown on American-operated scheduled air lines, and 248,954 passengers and 712,-638 lb. of express carried. These figures represent increases of 17, 25, 28, and 70 per cent over the same period last year. In flight to accomplish this record were 580 aircraft, 558 pilots and 167 co-pilots, while on the ground the airlines gave employment to 1,929 mechanics.

Accidents in the course of scheduled air transport operations during the first half of 1932 were slightly more numerous than in the same period last year. Pilot fatalities were .40 per million miles flown, while the passenger fatality rate was .25 per million passenger miles, compared with rates of .25 and .19 respectively in early 1931.

Following the success of the first 100-minute plane put into service between St. Louis and Chicago early in June an additional schedule was added on Aug. 1 by Braniff Airways, which recently moved their executive offices from Kansas City to Oklahoma City. The new plane, leaving St. Louis at 6.15 p.m., arrives in Chicago at 7.55 p.m., where it makes direct connection with United Air Line planes reaching Cleveland at 10.40 p.m., and New York at 1 a.m. the following day. Seven-passenger Lockheed Vegas powered with 425 hp. Wasp engines are used.

New schedules also bring St. Louis closer than ever before to the West Coast and the Twin Cities. Passengers and mail leaving St. Louis at 10.30 p.m. on American Airways planes change to United at Omaha at 4.37 a.m., arriving in Denver by noon and San Francisco early the same evening. A midnight departure from San Francico on the return flight brings one to St. Louis at 10.31 the next evening. The trip from St. Louis to Minneapolis and St. Paul is now made in less than twelve hours.

A stagger system for weather broadcasting along the airways, announced by the Department of Commerce in Supplement No. 2 to Instruction Bulletin D-5, is now in effect. Pilots having missed the hourly weather report for any section may tune in on another station along the same airway and receive the same information five minutes later. Under the old system the hourly reports were transmitted simultaneously by all the weather stations along the airway.

An airplane shuttle service between Springfield and Hartford was recently inaugurated by the Commuters Air Service Inc., which has Charles Deeds, vice-president of Pratt & Whitney Aircraft, as president and treasurer. Single-engined Stinson monoplanes and Sikorsky amphibions fly the fifteen-minute schedule connecting at Springfield Airport with the Boston-bound planes of Inter-City Air Line and at Hartford's Rentschler Field with American Airways' planes to Newark and points west and south. Fare for the flight, made five times daily in each direction, is $2.62 one way and $5 round trip.

Pan American grows

A third 44-passenger Clipper ship was recently ferried from the Sikorsky plant at Bridgeport to Miami, Fla., to join the fleet of Pan American Airways. Embodying several improvements based on experience with its two sister ships, which have been in service for some time on the trans-Caribbean run from Miami to Barranquilla, Colombia, and between Miami and Havana, the new and nameless Clipper will help take care of the traffic over the Caribbean to the West Indies and Central and South America.

The same organization which serves the Caribbean Islands and the Southern hemisphere now also operates the northernmost American airlines. With the purchase of Pacific International Airways by Pacific Alaska Airways, wholly owned subsidiary of Pan American, all the airways in the territory are brought under its control. A few weeks ago Pan American, through the same subsidiary, took over the assets, business, and mail contracts of Alaskan Airways, subsidiary of the Aviation Corporation. The unified Alaskan lines will have headquarters at Fairbanks, include more than 3,000 miles of airways, more than all the railroads and wagon roads in the territory combined. Until a survey as to the type of equipment best suited to Northern conditions can be completed the Wasp-powered Fairchild planes aequired with the lines will fly the routes, but two-way radio equipment will be added as soon as possible. Present schedules will be maintained and extended as business requirements indicate. The newly acquired lines, which have been operated for two years by Edward H. Lowe, Jr., of Grand Rapids and San Francisco, join the inland cities of Tanana and Nenana with the seaeoast at Nome and Kuskokwim Bay.

Trans-Atlantic air mail in sight

In another field in which Pan American represents American interests, that of the trans-Atlantic airlines, Germany and France seem to be making the greatest progress. The Westfaleo, 5,000 ton North German Lloyd liner chartered by Deutsche Lufthansa to serve as mid ocean airport on its South American service, is even now undergoing equipment tests in the North Sea. Too small to permit deck landings, it will drag a rig to produce a quiet area in its wake, from which incoming planes can be hoisted aboard. Early this winter the Westfalen is scheduled to take its place in the South Atlantic.

With Dec. 31 next, the limit date after which the Argentine Government will withdraw its support if the ocean section of Aeropostale's Paris-South America air route is not in operation with aircraft, construction is being rushed on the new flying boat designed by Philip Zapata for use on this stretch. A high wing monoplane powered with four 640 hp. Hispano Suiza engines, it is nearing completion at the Bleriot plant.

Air mail service between Belgium and the Congo was opened on Oct. 1. Five Fokker monoplanes maintain the service, which runs twice a month in each direction.

Internal air lines in the Union of South Africa, a subject of heated debate for several months, is still a moot question. Renewal of the three-year contract with Union Airways which was to expire on Aug. 26 was protested as placing the development of air transportation in the Union in foreign (German) hands. This company, operating a weekly service between Capetown, Port Elizabeth and Durban, and between Port Elizabeth and Johannesburg, is controlled by Junkers South Africa, Ltd. Equally strong objections were raised to two offers by Imperial Airways, and South Africans showed themselves unwilling to invest in local airline operation. The last suggestion reported was that the Union Airways' contract be extended for one year, or until definite legislation regarding the whole air transport question can be enacted.

Imperial Airways on Sept. 5 gave a new impetus to desert travel with the opening of an air service which saves travelers between Palestine and Iraq a two-day journey by desert car. Lynx-powered Avro (Fokker license) "Ten" trimotor monoplanes of the type used for some two years by Australian National Airways on its Brisbane-Melbourne route make the trip westward from Bagdad to Baldee in 5½ hours and eastward from Ramleh to Bagdad in about two hours more. Connection is made with the Lloyd Triestino steamers and negotiations are under way to secure joint air and steamship service with through fares.

Another new tropical service was inaugurated a few weeks earlier to link Nairobi, on the London-Capetown route, with Mombasa, Tanga, Zanzibar and Dar-es-Salaam on the east coast. Connections with Imperial Airways are now made in a trip of a few hours instead of the several days previously required.

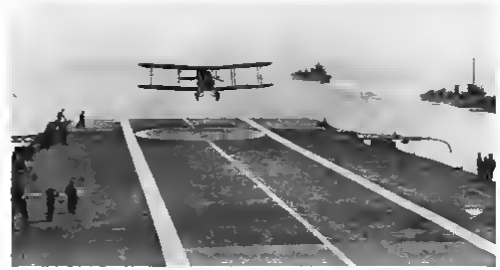
Upon the ratification of an agreement made recently between Italy and Czechoslovakia a new air service between Trieste and Prague will be opened. The operating company of each country will fly the route three times a week, but the Czechoslovakian compaoy may operate daily until the Italian company is in a position to maintain its part of the service.

Linking the Soviets

Air transportation in Soviet Russia, second only to the United States with its 35,000 miles of airlines in active operation, is now under the direction of Transaviatsia, a new organization within the Soviet civil aviation system. The major function of the new division is the organization throughout the USSR of uninterrupted mail and passenger service and the increase of the number of planes and airports, and of radio facilities. New lines from Moscow to the newly-created industrial centers of Stalingrad and Magnitogorsk were opened during the summer, as well as the second section of the Trans-Siberian airline connecting Irkutsk with Vladivostok and the large cities of the Soviet union with principal Far Eastern points. A line between Khabarovsk and Petropavlovsk is under construction to connect the coast of the Okhotsk Sea and Kamchatka with the central part of the Far Eastern region. Under the second five-year plan the length of airlines is expected to increase to 187 000 miles by 1937, with day and night service the year round.

The Soviet project to develop airships as an adjunct to air transportation passed its first milestone upon the launching of the S S S R V-3. This first product of the State Airship Factory at Leningrad supervised by Umberto Nobile has a volume of 230,000 cu. ft. to carry ten people and something over a ton of freight a distance of 1,250 miles. The erstwhile designer of Italian airships and member of the tragic polar expedition of the Italia, now Deputy Chief of Soviet Airship Construction, will command the S S S R. on its maiden flight from Leningrad to Moscow.

Solution of long distance transportation problems by use of airships is being considered in Holland as well as Germany. Two well-known Dutch shipping companies, the Royal Netherlands Steamship Company and the Rotterdam-Lloyd, faced with the necessity of replacing part of their fleets, recently formed the Syndicate for Airship Traffic with the Netherlands East-Indies to investigate the wisdom of replacing steamships with airships. In close touch with Dr. Eckener, the syndicate sent Mr. J. E. van Tijen as its technical representative to Friedrichshafen, and to join the Graf Zeppelin on the remainder of its flights to South America this year. Mr. van Tijen well-known private pilot, in 1930 made a trip to Batavia in a single-seater plane on business.



ON A BRITISH DECK

A torpedo plane about to land on the deck of H.M.S. Courageous

The Army's new pride

Last word in non-rigid airship construction in the United States is the TC-13 now nearing completion by the Goodyear-Zeppelin Corporation at Akron for the Army Air Corps' coastal patrol work. With an overall length of 233 ft., a diameter of 54 ft., and a height of 69 ft. including the car carried underneath, it will be the largest non-rigid in the United States. A capacity of 360,000 cu. ft. of non-inflammable helium gas gives it a gross lift of 22,300 lb. The largest airships now operated by the Army have a gas capacity of about 200,000 cu. ft.

Five control surfaces instead of the usual four are a distinctive feature. The slup carries from 900 to 1,300 gal. of fuel and may be refuelled during flight. Tanks for fuel, water and storage can be dropped by the pilot at his discretion to provide greater buoyancy. The corrugated metal car, supported by cables from the top of the inside of the gas compartment, has space with complete sleeping accommodations, for three pilots, two mechanics, a navigator, radio operator and bomber. In the improved model subcloud car, original with the Army Air Corps, an observer may be lowered to report actions below by telephone to the airship lurking in the clouds 1,000 ft. or more above.

Sometime early this month Navy aeronautical experts expect to begin experimentation with the Akron's new

telescopic mast, begun a year ago and now ready for installation at the Lakehurst station. Capable of expansion to 160 ft. in height, the mooring mast operates about the field and into the dock on standard-gage railroad tracks. In addition to reducing the ground crew from 200 to 60 men, it will permit landing the Akron with minimum strain on its construction.

New planes go abroad

American airplane factories, in common with other industrial plants, during the first six months of 1932 were barely half as productive as during the same period of the previous year, when 1 606 planes were built. Of the 722 planes manufactured this year, 351 are destined for domestic civil use. Planes for delivery to purchasers in foreign countries, though somewhat fewer than the f931 total for the same period, form a much larger percentage of this year's production.

South Africa will be the home of two Continental-powered Waco cabin planes, one purchased by the Durban Light Airplane Club, the other by Herholdt & King, distributor at Johannesburg, for demonstration work.

Nine 525-hp Wright Cyclone engines go to France for the three Fokker trimotor monoplanes recently ordered by the French Air Union. They will be assembled by the Societé Francaise Hispano-Suiza, which holds a license from the Curtiss-Wright Corporation for the Wright series.

The first of five Fokker F-18 monoplanes powered with three 440 hp Pratt & Whitney Wasp engines ordered by the Royal Dutch Airlines for their service to the Far East recently made its first public appearance. With a cruising speed of 126 and a maximum speed of 152 m.p.h. these planes carry four passengers, mail and freight from Amsterdam to Batavia in nine days.

Part of the foreign penetration into France is being made by deHavilland Gypsy IIf engine. 100 of which have been granted purchase premiums at the rate of $440 per engine by the Commission d Avions de Tourisme. They are to be assembled in France. Homologated in France at 105 hp., the Gypsy fff engine is being fitted into the Marcel Bloch 90 monoplane, the Caudron Luciole two-seat light biplane, the Farman 231 two seat monoplane and the new Caudron Phalene and Morane-Saulnier cabin monoplanes, both copies of the deHavilland Puss-Moth.

Wright Whirlwind engines of 300 hp power the tri-motor Fokker F-7 being flown on the new air service between Zurich, Switzerland and Milan, Italy, inaugurated Aug. 1 by Avio Linee. The new Italian airline crosses directly over the Swiss Alps at an altitude in unfavorable weather of almost 20,000 ft.

Approved type certificate number 87 has been issued to the Wright Aeronautical Corporation for its 365 hp. engine, also approved for commercial use at ratings of 300 hp at 2,000 r.p.m., 420 hp. at 2,150 r.p.m. and with or without propeller reduction gears of 2 I and 1.58 1. Thirty two of the new nine-cylinder Whirlwinds, now given a rating of 365 hp. in place of the old 300, were recently delivered to the Army Air Corps.

Sixteen Bristol Mercury engines, which give a maximum of 560 hp. at an altitude of 16,000 ft. and are one of the latest types of power units to be put into production at the Bristol factory, have been ordered by the Danish Government. They will power that number of Bristol "Bulldog" single-seater fighters to be built at the Royal Army Aircraft factory at Kastrup, under license obtained early last spring by the Danish Government.

At the Bremen Airport the first German autogiro, built under license from the de la Cierva patent by Focke-Wulf, producer of the experimental tail-first "Ente" and of normal transport planes, has been undergoing flight tests. A two-place sport plane powered with a 100 hp. Siemens SH-14 engine, it has three folding rotor blades and is similar to the latest British autogiro, except for its open cockpit.

Price reductions, anticipating a greater volume of production and bringing the autogiro $1,635 nearer to the average pocket, were recently announced by the Kellett Autogiro Corporation. Model K-3, a two-place, side-by-side seater, powered with a 210-hp Kinner engine is now $6 250, flyaway Philadelphia Airport, the lowest priced autogiro in the United States.

Corporations Report

Profitable operations during the quarter ending June 30 are reported by several major aeronautical organizations. United Aircraft & Transport Corporation, whose principal subsidiaries are Boeing Airplane, Pratt & Whitney, and Hamilton Standard Propeller Company, earned $322,860 after all charges and preferred dividends. This is about 15½ cents a share on 2,084,319 shares of common stock outstanding, each of which earned 12 cents during the first three months of the current year.

Thompson Aeronautical Corporation, which operates Transamerican Airlines, during the six months ended June 30, netted a profit of $12,119 or 14 cents a share on 88,442 no par shares outstanding. No comparative figures for the previous year are available.

Less favorable are the announcements of the operators of American Airways and Eastern Air Transport. Aviation Corporation and its subsidiaries for the first half of f932 showed a net loss of $2,565,371 after all charges. At the half-way mark last year the loss reported was $729,480.

North American Aviation, Inc., holding company for B/J Aircraft Corporation, the Ford Instrument Company and Sperry Gyroscope Company, as well as Eastern Air Transport, lost $196 688 during the first half of 1932. In the same period of 1931, each of the 2,118 969 shares outstanding earned about .25 cents. The financial condition of this and other air mail operators was adversely affected in the second quarter of this year by a sharp temporary reduction of payments on contract air mail, due to the deficiency in the budget of the Post Office Department.

Personnel

William B. Mayo, director of the aviation division of the Ford Motor Company, has announced his resignation. Chief engineer of the company for the past nineteen years, it was under his guidance that the tri motor transport plane was developed.

G. T. Weaver, Transcontinental & Western Air pilot between Columbus and Newark, has been appointed division superintendent, with headquarters at Newark. He succeeds A. D. Smith, who is appointed superintendent of the mountain division at Albuquerque, N. Mex.

Lester D. Seymour, vice-president of United Air Lines and of its various divisions, has announced his resignation. Mr. Seymour had been with United Air Lines since 1926 when he resigned an Army position to enter the employ of National Air Transport.

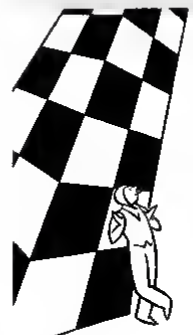
Lieut. Comder. Vincent Arthur Clarke, former commanding officer of the USS Los Angeles and mooring officer of the Sunnyvale Naval Air Station, died at the Mare Island Naval Hospital on Aug. 10. After duty in command of submarines during and subsequent to the War, Commander Clarke was assigned to the Lakehurst naval air station and the lighter-than-air service, with which he was associated until his death.

Lieutenant Ariosto Neri of the Italian Air Force, who a few months ago narrowly escaped death while establishing a new but unofficial world's air speed record, was killed on Sept. 6 in the crash of a naval pursuit plane over Lake Garda.

Robert J. Eaton, young glider pilot whose flights at the National Soaring Meet at Elmira in July were of record caliber, was accidently killed on Sept. 7 at the Chenango Lake (N. Y.) summer home of his parents.

SIDE SLIPS

By Robert R. Osborn



Report of the National Air Races

By Side Slips' Special Correspondent

(Annual apologies to Ring Lardner)

DEAR EDITOR.—Well Ed, I am glad to report that I and Mr. Greve, an Cliff Henderson an Pop Cleveland an others has put over another successful National Air Races. A course you has beco reading more about the others in the papers, but as I has exclaimed in the past this is only on account of my great modesty, I staying in the background an letting the others take the credick. In fact I am getting quite proud the way the other boys handle things when I am not there, an it is getting so I would not have to be on hand at all, only there would not be the crowds in the stands if it got noised around I would not be there.

The races was about the same as usual only they was fewer races each day than other years, an the rumor got around maybe next year they would have qualifying one day and the race the next day. No reasons was give out for the reduced no. of races, but I am sure it was on account the timers, Mr. Schory an Mr. Underwood, being overworked. Few as the races was they would hardly be half ways through a hot dog an roll or maybe a plate of ice cream an they would be another race to bother them. An then with as many as two races per day they is liable to get them confused, for instinct, one day they had been working themselves all hot and bothered for half an hour timing ships as they passed the home pylon before they discover it was the Army pursuit group doing some formation work. The timers stand is much more impressive than they used to be on account all the complicated machinery they has now installed. They has more whirling an ticking machinery than a 1929 stock brokers office, but like in the old days of the stock market they is still half hour or so behind the market. You may think from this I has a grudge against Mr. Schory an Mr. Underwood but this is not so in spite the fact they had me thrown out the timers stand even when I told them who I was.

A course they was many amazing ships designed an entered in the Thompson Trophy Race, but on looking them over I has decided there is not so much to this racket of designing racing planes after all an it is quite simple. You just clip some more wing area offen your last years model an then bawl h—l out of the engine mfr until he gives you more power for the same size engine. I has always maintained that wing areas has been reduced so much the wings might just as well be cast on the crankcase of the engine an we may see this come to pass by next year.

So far as racing pilots is concerned I can say that if any mother wants her son to be a good one she had better name him Jim. Practically all of the prize money during this race session was took home by the following Jims,—Jim Doolittle, Jim Haizlip, Jim Weddell and Mrs. Jim Haizlip. An I can cover the situation very well by exclaiming that Jim is certainly a good pilot. In addition to the Jims on the field, up in the Press Box was Jim Doolittle Jr. an Jim Haizlip Jr. giving the press boys all of the inside dope on the families. Having listened to them for two hours I can report there either is no scandal in either family or else the boys are good publicity agents.

Newspaper man: "Well, Jimmie, what do you think of your mother now?"

Jim Haizlip, Jr.: "Why, what's she done?"

N. M.: "She set the world's speed record for women today."

J. H., Jr.: "How fast did she go?"

N. M.: "Forty-five miles an hour faster than the old record."

J. H., Jr.: "I mean how fast in miles an hour?"

N. M.: "Two hundred and fifty miles an hour."

J. H. Jr.: "That's pretty fast, but shucks Dad can do better than that with the ship."

One of the lads what was on the handicapping committee for one of the womens races, Georga Patterson by name, had the thought that they should be a magician, or crystal ball reader on that committee next year on account they need to know what courses the ladies intends to fly. It seems that they carefully figured handicaps out thinking they was all going to fly versus each other on the same course, whereas some flew the ten miles course, some the five mile course, some half way between. One of the gals flew a separate course between two wireless towers an a windmill, an one other just flew around the field reading the Standard Oil advertising on the canvas fences. However, don't get no idea that these gals isn't good pilots when they get experienced, as them what was in the Aerol Trophy Race don't come no better. You remember that all during the races in California the natives inform us that it wouldn't rain until Dec. 16th and sure enough it didn't. Well here in Cleveland they can't even tell what tha weather will be at the end of a race when they starts it. During this here Aerol Race the worst rain an fog you ever seen come up, an these gals kept right on flying through it. It was so bad you couldn't even see the home pylon an yet when the race was over the timers all had times for that race to the thousands of a m.p.h. If that don't confirm my suspicions about these timers, —well I leave it up to Samuel Seabury.

A course the hard times prevented many of the boys from attending these races as per usual an I was disappointed to see many faces missing. Last year many of them was there even when they had to come by box car, but I guess there wasn't enough freight cars moving this year.

As a ornamental feature around the geounds this year they had a live duck swimming in the poof in front of the stand. At the end, when they was handing out the cups and plaeque prizes at the judges stand, I seen one of the boys looking longingly at that duck, and I thought he might offer to trade his placque for tha duck, but no, his gentlemanly instincks prevailed. The facts that the duck survived during the week proves that times isn't as hard as some folks would have you believe. On the other hands, duck is awfully hard to tell apart an it might have been a new duck each day the management had to provide. However don't get the ideas that I think things will always be in a bad way, as I was thinking America was fundamentally sounds before Mr. Hooverb announces himself versus that theory. On the other hands after observing some of the costumes the lady pilots wore to this race an previous ones I have come to the conclusions we should have paid more attention to that old slogan, "Don't sell America shorts."

Y'rs V'y Tr'ly

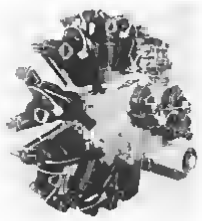
The Intrepid Aviator.

FLYING EQUIPMENT

High horsepower—low specific weight

ALTHOUGH the manufacturer claimed a rating of only 650 hp for the new Cyclone R1820-F, developed by the Wright Aeronautical Corporation in co-operation with the United States Navy, the Department of Commerce has issued A.T.C. No. 89 covering this engine with a rating of 700 hp at 1900 r.p.m. using 87 octane fuel. Based on this rating, the specific weight of 1.22 lb. per hp is said to make the new Cyclone the lightest production engine in pounds per horsepower, and the most powerful single-row radial engine in the world. Tests have indicated that it will develop 600 hp at altitudes better than 12,000 ft.

Although the Cyclone F has the same displacement as the previous models which it now replaces in production, a number of changes have been made as a result of the service experience with the earlier Model E. Perhaps the greatest single change, and the one which accounts for a number of other modifications, is the complete redesign of the supercharger section. Where the older impeller was 7 in. in diameter and rotated at top speeds of 18,000 to 24,000 r.p.m., the new one is 11 in. in diameter and revolves at only six times crankshaft speed, or 12,000 r.p.m. at full throttle. A centrifugal band-type clutch between the impeller drive and the crankshaft relieves the supercharger gear train of the high inertia forces in rapid accelerations and decelerations of the engine.



The new Wright Cyclone

The change to the larger blower necessitated a complete re-design of the entire supercharger section, including a material shortening of the crankshaft which moved its critical period of vibration well out of the operating range.

The crankcase is built up of six principal sections of heat-treated aluminum and magnesium alloys. The front cover contains the main thrust ball bearings and furnishes support for the cam followers which actuate the valves through the usual pushrod and rocker combination. The main section of the crankcase consists of two heat-treated aluminum alloy forgings which replace the one-piece cast case of the Model E. The front section of the supercharger, which is bolted directly to the rear section of the main case, forms the forward wall of the supercharger diffuser and distribution chamber, and acts as a support for the entire engine, as the mounting ring bosses are cast as an integral part of it. A separate cast magnesium oil sump, located between cylinders five and six, is fastened at the rear of the supercharger front section. The cast rear section bolts directly to the front section to complete the diffuser chamber. A "down-draft" Stromberg NAU-8F carburetor is mounted on top of this section and communicates with the impeller intake through passages cast integral with the diffuser plate. This section also carries the gun synchronizers and a fuel pump. The cast rear cover, which is in the form of a flat plate, is bolted to the supercharger rear section and provides a mounting for two Scintilla VAG-9DF magnetos, Eclipse generator and starter, the oil pump and tachometer drive. All the principal accessories are driven through spur gears.

The cylinder heads have been redesigned to give improved cooling. The fins are spaced more closely, and baffles are provided to deflect the air to the rear of the cylinder barrels. Spark plug coolers have been cast integral instead of being separately inserted as on the Model E engine.

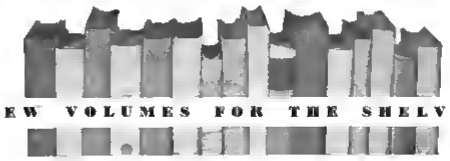
Forged aluminum alloy pistons replace the cast pistons used in the Model E. The underside of the head is heavily ribbed to increase the strength and improve the cooling. The valves and valve springs are similar to those of the Model E, although the exhaust valve has been slightly increased in diameter. The rocker box covers are of the type which permits the installation of ring cowling. This change has made the engine about 1 in. smaller in overall diameter.

Fairchild on Edo floats

Approval was recently granted by the Department of Commerce for the mounting of a Fairchild 22 monoplane on Edo Model 185-D floats. The installation was made by attaching the floats directly to the outrigger landing gear fittings, without necessitating changes in the basic design.

Latest Wilford Gyroplane

This model, which is fitted with a flat-topped rotor and a Jacobs seven-cylinder radial engine has been undergoing an extended period of test flying recently at Wings Field, Philadelphia. The machine is so designed that the fixed wing carries the major part of the load at high speed, with the rotor functioning as the principal lifting device during take-off and landing.



TECHNICAL REPORTS OF THE AERONAUTICAL RESEARCH COMMITTEE *(British) for 1929-30 and 1930-31, H. M. Stationery Office; 1931 and 1932, two volumes each year; 727 and 670 pages for 1929-30, 391 and 505 pages for 1930-31 (together with a great many unnumbered pages of illustrations in each case); approximate prices $8 each volume for 1929-30, $4.50 and $6 for 1930-31.*

IT IS impossible to summarize works so varied as these, or to review them except by passing on their general quality. That is as high as ever, and the four volumes here covered must take their place with the thirty-four preceding collections of Aeronautical Research Committee Reports on the shelves of any serious student of aerodynamics or of any aeronautical library. In accordance with past practice, general aerodynamics is covered in the first volume each year, while stability and control, spinning investigations, engines, materials, and other miscellany go into the second. Although a number of reports on purely mathematical questions are included in the aerodynamic volumes, eighty per cent of the contents will be available for the use of a designer having no knowledge of higher mathematics. Laboratory results are admirably presented, both in tables and in graphs, and the text is much better prepared and includes a larger measure of intelligent discussion and interpretation than is the common rule with engineering laboratory reports.

An idea of the scope of the work can best be given by taking a few particular sections. Thus, the portion of the 1929-30 report devoted to control covers almost 100 pages, divided among eleven reports, most of them bearing on full-scale studies of lateral control. The section on materials includes examination into the properties of many elements and light alloys and general studies on high-frequency fatigue and corrosion. The reports on engines cover the mechanism of combustion and detonation, the design of flowmeters, wind tunnel experiments on steam radiators, and a lengthy experimental and theoretical investigation of the torsional vibrations of crankshafts. Other sections attain the general level of variety and completeness indicated by those samples.

•

ANNUAL REPORT OF NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS FOR 1931 *Including Technical Reports; Government Printing Office, Washington, 1932; 722 pages, $3.*

EVERYTHING that has been said of the scope and importance of the British Aeronautical Research Committee Reports applies with equal force to those of the American Committee. The procedure in publication in the two countries is of course somewhat different. The British Committee has nothing like the National Advisory Committee's Technical Notes and Technical Memoranda, and their reports are as a general rule somewhat briefer and more narrowly specialized than those of the American organization.

Of particular interest among the 36 reports included in the current N.A.C.A. volume are those covering the performance of various types of rubber shock absorbers and of airwheels, those on the tests of airfoils and airship models in the variable density tunnel at Langley Field, one covering the rational design of slotted wings, and several on fuel injection mechanisms for Diesel engines.

•

ERGEBNISSE DER AERODYNAMISCHEN VERSUCHSANSTALT ZU GÖTTINGEN; *Edited by Dr. L. Prandtl and Dr. A. Betz, R. Oldenbourg, Munich, 1932, 148 pages, $3 approximately.*

THIS is the fourth volume of reports from the famous Göttingen laboratory. As in the past, the investigations reported cover a very wide range, a part of which is only incidentally aeronautical. They include, for example, tests on ventilators of various types, measurements of the pressure distribution over airship hangars and gasometers, tests on rotating cylinders, and investigations of the properties of multiple venturi tubes. On the more purely aeronautical side the greatest amount of attention is given to airfoils, alone and in combination. Seventy-six new sections are presented, none of them appearing to have any very marvelous properties. The book also contains the record of a useful study on the interference between wings and fuselages and on the effect of fillets of various types.

•

REPORT ON CANADIAN CIVIL AVIATION, 1931 *Department of National Defence, Ottawa, Canada. 86 pages, 25 cents.* The customary annual summary. A mixture of narrative and statistics. All phases of Canada's aeronautical interests and activities are covered, with photographs and maps. Air survey receives relatively less attention than in the past, air transport somewhat more.

AVIATION AND LIFE INSURANCE, *by Ray A. Dunn, Dillon Publishing Company, New York, 1932, 168 pages.* A useful compilation of information on aircraft accidents and on the present practice of life insurance companies. Based on a pamphlet prepared for the Guggenheim Foundation two years ago. Somewhat heavy for ordinary reading, but can be strongly recommended to the statistically-minded and to those in any way connected with aviation insurance.

THE SKYCRAFT BOOK, *by Laura B. Harney, D. C. Heath & Company, New York, 1932, 330 pages, $1.08.* A history of aviation with incidental reference to how aircraft fly and to what they are

now doing, apparently intended mostly for children As compared with Hodgins & Magoun's "Sky High," or Wead's "Wings for Men," fitting a somewhat similar field, Miss Harney's book has the virtue of cheapness, but no other perceptible advantage. The text shows little discrimination, and the illustrations appear to have been selected from wherever they could be obtained most easily

METAL AIRCRAFT CONSTRUCTION, *by M. Langley, Gale & Polden, London, 1932, 235 pages, $4 approximately* A straightforward description, with innumerable illustrations of metal construction practices in aircraft of many types. It is weak only in that it virtually ignores American development, being concerned principally with British, and secondarily with German, Dutch, and French, practice. Nevertheless it is by far the best book of its type, and a necessary addition to a good design library.

A GENERAL TEXT ON AERONAUTICS, *by H. F Lusk, Ronald Press Company, New York, 1932, 104 pages, $3 25* A general review, intended for use in technical high schools, junior colleges, and the like. Very good as a broad summary of the principles of operation of aircraft, engines, and instruments, and especially of the principles of aerial navigation and meteorology. The book appears, in fact to be better suited for those preparing to train themselves as pilots than for prospective mechanics or ground employees

AIRPLANE PILOT'S MANUAL, *by Ross Mahachek, G P Putnam's Sons, New York, 1932, 383 pages, $5* A thoroughly workmanlike book by an experienced pilot Mr. Mahachek covers the whole subject, from the application for a student permit up to the problems of fog flying and advanced acrobatics, with incidental mention of a few mechanical questions bearing on the selection of a private plane and on its maintenance. For American readers, at least, this book is distinctly superior to Captain Barnard's recent volume, or to anything else now available

CAPE TOWN TO CLYDE, *by Richard Humble, Longmans Green & Company, New York, 1932, 91 pages, $1 25 approximately* An account of a 10,000-mile trip by a British couple in a light plane. Interesting, especially to private pilots, though not particularly important. Includes a full statement of the costs of the trip

AIRCRAFT ENGINE MECHANICS MANUAL, *by C John Moors, The Ronald Press Company, New York, 511 pages $4.50* An excellent engine manual, probably the best of its kind that has appeared Soundly practical without neglecting theory Mr. Moors treats very clearly of the general principles of engine design, operation, and maintenance, and then applies them to particular much-used engines and accessories Completely avoids the appearance, exceedingly common in such volumes, of having been assembled with shears from a collection of manufacturers' handbooks

AVIATION AND THE AERODROME, *by H A Lewis-Dale, J B Lippincott Company, Philadelphia, 1932, 168 pages; $6* A good elementary summary of the airport problem, with special reference to British practice and with all costs, etc., drawn from British sources Almost no mention is made of American fields or problems The book will be of interest in the United States only to airport designers and engineers who will find it useful to compare American and European ideas.

AN ANALYSIS OF METEOROLOGY AS RELATED TO THE OPERATION OF AIRCRAFT, *by Harold Lewis Kirby, The Arthur H. Clark Company, Glendale, Cal., 1931, 120 pages* A simple manual for the use of pilots. It covers both military and commercial requirements, and is admirably adapted to its purpose A very complete index makes it useful as a reference manual

BLIND FLIGHT IN THEORY AND PRACTICE, *by Maj Wm. C Ocker and Lt. Carl J. Crane, Naylor Printing Company, San Antonio, Tex., 1932, 200 pages* This is the superlative text on a very much discussed subject It is the first and the last word from two men who are perhaps more experienced in the actual development of blind flying technique in instruments, and in the training of pilots to fly blind, than any others in the world It covers the whole subject—theory, history, and present practice

A MANUAL OF RIGGING FOR AIRCRAFT, *prepared by British Air Ministry, published by H M Stationery Office, London, 1931, 170 pages; $1 25 approximately* A general rigging manual in loose-leaf form It of course refers particularly to British practice, and would be of only limited use for American mechanics. Leaving that aside, however, it is an admirably prepared volume, and undoubtedly superior in illustration to anything of the sort published in the United States

THE MOTH TWO-SEATER LIGHT AEROPLANE, *prepared by the British Air Ministry, published by H M Stationery Office, London, 1931, 72 pages and about fifteen plates; 60 cents approximately* The well-known DH Moth, favorite of British private pilots, is also in use as a training plane in the Royal Air Force Hence this volume of official description and maintenance data It is obviously of primary interest to Moth owners, but American engineers should find the exceedingly detailed description of interest as indicating what Great Britain considers to be the best practice on light and relatively low-priced machines

ILLUSTRIERTE TECHNISCHE WORTERBUCHER, *by Alfred Schlomann, Vol. 17, Aeronautics, VDI-Verlag, Berlin, 737 pages* The first edition of Schlomann's technical dictionary, which appeared before the War, was a veritable triumph This, the latest version, completely eclipses it It contains the equivalent in four languages (English, French, German, and Italian) of some 17,000 aeronautical words and expressions, with many pictures to make matters clear to anyone who isn't exactly sure what term he is looking for in any one of the four languages, and with an index covering all four It gives an idea of the thoroughness of the treatment to find such expressions as "transshipment of air freight" and "distance of the airscrew hub from the center of gravity of the airplane," included with their French, German, and Italian equivalents

SAILPLANES, THEIR DESIGN, CONSTRUCTION, AND PILOTAGE, *by C H Latimer-Needham, Chapman & Hall, London, 263 pages, $4 approximately* Practically all glider books in English have been written from the point of view of the novice pilot. This is the first intelligent study of the design of soaring planes in any language other than German It is admirably written and admirably illustrated, not only in the section dealing with design and construction, but also in that concerned with the practice of soaring

KESTREL AERO ENGINES, *British Air Ministry, 178 pages and about 60 plates, $1 20 approximately* A complete handbook of description and direction for maintenance and overhaul of the 500-hp. Rolls Royce engine. The description is exceptionally full, and well illustrated

REPORT ON THE PROGRESS OF CIVIL AVIATION, 1931; *Air Ministry H M Stationery Office, London, 95 pages, $1 20 approximately* The customary exhaustive annual review of the world's civil aviation, and especially of that of the British Empire. For the British Empire the report covers not only air transport but also new aircraft design, the operations of the light airplane clubs, and miscellaneous flying Pocketed inside the back cover are a number of excellent maps covering the air transport routes of the whole world

AIRCRAFT AT WORK

Annual elk census taken by plane

THE annual census of the elk herd in the Jackson Hole, Wyo., feeding grounds was done largely by airplane last winter under the auspices of the Wyoming State Game Commission and the Biological Survey of the Federal Forest Service. It was found that the elk could be counted accurately and without duplication. The herd is being fostered by the State and National Governments in order to preserve this species in this country By using aircraft officials consider that the herd may be counted quickly, easily and accurately anytime there is snow on the ground This method is economical as well as convenient in controlling the animals

Ducks and mosquitoes objects of Army flights

AIR CORPS planes continue to be used in extraordinary missions which suggest possible future employment for commercial machines, if the Army work indicates the advisability of large-scale operations it would not care to undertake. Conservation of ducks and the destruction of mosquitoes have been the most recent examples.

Major Brower during the winter flew a C-4 transport plane from Selfridge to the mallard duck feeding grounds in Lake St. Claire and dropped sacks of grain on the ice. Twenty bags carrying 25 lb. of grain each burst and released the grain as they struck the ice Similar flights were to be made later if the shortage of ordinary sustenance for the ducks continued A Bolling Field plane under auspices of the Department of Agriculture was used to make aerial photographs of various groups of ducks resting on the water in the vicinity of Washington in an effort to obtain a key by which groups of ducks may be recognized at a glance Various breeds of ducks form characteristic patterns while resting on water

In the Canal Zone Army planes are being used in further experiments for the Public Health officials with spraying of mosquito areas Effective altitude for the spraying operation has been lifted from 25 to 150 ft and further improvement is being sought by the development of better compressed air units for use with larger tanks of oil A bomber of the Eighteenth Composite Wing in Hawaii has been fitted with mosquito traps and is to be used in flights over the mountains of Oahu in an effort to determine the source of mosquitoes which appear in Honolulu The traps consist of plates smeared with an adhesive preparation Capture of mosquitoes on these plates will give a clue to the direction from which they come and other factors useful in the fight against the pest.

Giro effective in promotion plan

THOUSANDS of miles have been flown by Lewis A Yancey in the Champion Spark Plug Company's Pitcairn autogiro during a year's promotion program featuring the aircraft. The most spectacular phase was the trip from Miami to Havana, across the Caribbean to Merida, Yucatan, and on to Brownsville by way of Mexico City This flight brought the giro into the Latin American areas for the first time

During his stay at Merida, Yancey flew the giro a number of times to the Chichen Itza site of the Mayan ruins.

The Champion giro at Chichen Itza

Planes fight oil fire in Mexico

RECENTLY a novel use was made of airplanes in an effort to check a disastrous fire which was raging among the storage tanks of the Hutseka Oil Company at Tampico, Mexico. It was impossible of course, for the planes to approach tanks which were actually on fire, but effective use was made of them by spraying flame-smothering chemicals over adjacent parts of the reservation to prevent the spread of the flames

Flying lobsters to Buenos Aires

THE epicures of Buenos Aires and Montevideo were enabled to secure their supply of West Coast lobsters in spite of suspension on the transandine railways Shipments of as many as 300 live Chilean lobsters, taken from Juan Fernandez Island, were made by air over a 760-mile route across the Andes The Island, incidentally, is famous not only for its production of shell fish but also as the home of Daniel DeFoe's "Robinson Crusoe." The fresh lobsters from this source bring better than $2 a pound in the East Coast cities.

Fresh food for gold miners

THANKS to the airplane, the days when the personnel of isolated mining districts suffered acutely from shortage or spoilage of food, are in the past. Aircraft have been used not only for the dropping of relief supplies to parties cut off from civilization, but are now being used regularly to transport supplies, etc., to the permanent mining communities One good example comes from the South Seas where the Morobe gold fields of New Guinea are regularly supplied with meats, fruits, eggs, etc., from cold storage plants on the coast. Such foods are now shipped from Sydney to Salamaua and within an hour are delivered to an airdrome at the gold fields. Native runners then deliver the supplies to customers over an area of many square miles.

WHAT OUR READERS SAY

"Where Is the Executive?"

To THE EDITOR:

I appreciate the interest of Mr. J. B. Taylor's views, in AVIATION for July, yet I feel that, like many others writing an article of a somewhat critical type, he has done so without a thorough study of the operations of a number of manufacturers, and that his opinion reflects conditions that have been distinctly in the past for several years. It has been a long time since we have spoken or thought of manufacturing and selling Waco airplanes as a game. To us it is as prosaic as wheel barrows, hairpins or pencils, and our efforts are distinctly along the same lines.

We have felt that it is imperative, if we hope to continue in the field, to know exactly what it costs to design, manufacture and market an airplane as well as any other product, and it is not necessarily a lack of knowledge that results in a loss at the end of the year. In this plant we have the most accurate and thorough cost figures, with every part and operation accurately time-studied and its exact cost determined. Our finished costs naturally fluctuate from month to month with our net sales, but there are no questions or guessing in our manufacturing costs, nor have there been for some time past.

These cost sheets are consulted regularly. They are not determined once and filed, but are available to any member of the organization who has any possible use for them. When we are offered accessories from outside manufacturers our cost sheet on our own product is the first thing to be examined.

In addition to our cost system we have had in effective operation a most satisfactory wage incentive for the past four years, and while we do not claim it is perfect, we have found it highly satisfactory and of great interest to all who have studied it.

With no disrespect to our engineering department, in which we have the utmost confidence, we are not content to leave in their hands the type of ship to be built and the various items of equipment to be designated as standard on such ships. On questions of this sort, opinions of the management, engineering department and sales department are studied and combined, and every possible effort made to provide the item that the public wants and will purchase.

Our various departments are operated under budgetary control. We know one year in advance the maximum amount of money we are going to spend on selling, advertising, engineering and experimental activity. This is all based on estimated net sales. If, at the end of the first quarter, sales are falling behind our estimates, we immediately curtail expenditures accordingly.

The work of test flying at the Waco Aircraft Company is not turned over to our engineering test pilot and considered as having been completely and definitely disposed of. Our engineering test pilot is an engineer, and as such, is far better qualified to handle this work then any other member of the organization. At the same time, it is fully appreciated that his viewpoint does not cover the man in the field. He is concerned, primarily, with the performance and with the requirements of the Department of Commerce for an approved type certificate. Again, his thoughts from an engineering viewpoint must be combined with those of the management and of the sales division, and modifications or changes made in accordance with the various ideas gathered. Also our leading distributors, the ones who are actually out in the field selling airplanes, are invited and urged to come and fly these ships, and express their opinions and ideas before the designs are adopted for production.

Furthermore, the Waco family, as a family, fly. None of us claim to be qualified test pilots in any sense of the word, but we do feel that we know what is going on in that department, and can adjust the purely engineering viewpoint to coincide to some extent with the sales and manufacturing viewpoint.

In the earlier days of the industry, it was possible to succeed with very little forethought or planning, but not so today. In our opinion, no commercial aircraft company has stood on its own legs during the past four years with any less supervision and guidance. The future will demand even more.

LEE N. BRUTUS
Vice-President
The Waco Aircraft Company

The 4-cent air mail letter

To THE EDITOR:

The principal objection from readers of my letter in the May issue of AVIATION [see also editorial in May] on a light weight 500 word letter-envelope at 4 cents, producing $3.84 per pound stamp revenue as against $1.32 per pound for present air mail at 5 cents per ounce, seems to be that they have no assurance that it will appreciably increase volume.

The principle of a limited service at a reduced rate (in this case the limitation is to a letter of not over 500 words) is an old and proven device, and I am listing below some comparable instances.

1. *Transportation.* (a) Reduced rates in *coaches* for week-ends and holidays on the theory that while the rate is low, the trains must operate, and if the coaches are filled, the revenue is almost all net gain. (b) Lower rate for Tourist Pullmans than Standard Pullmans.

2. *Communication.* The telegraph companies and the telephone companies have a large plant investment and a large, fixed overhead. Were it not for the night message and night letter, and the reduced night rates for telephone service, their equipment would stand practically idle half of the time. This is a very close analogy to our system of lighted airways and the mail planes running half full on their Watres Act capacity over these lines because of the high premium of air mail over rail mail.

3. *Amusements.* Operators of theaters use this principle by making a reduced rate in the afternoon. They also have the overhead, plant equipment, and the cost of entertainment on their hands, and in order to keep their houses fairly well filled for all performances, it is necessary to make a reduced rate for the afternoon performances.

4. *Merchandising.* The principle of limited service at a lower rate is very well illustrated in the case of the self-serving chain grocery stores. The housewife foregoes the privilege of delivery and a charge account for the reduced prices available if she waits on herself, pays cash and takes her purchases home.

No one can examine the average mail loads per trip on the air mail routes without realizing that the ships carry only part loads. Hence the advance from $1.05 per *pound* paid to the contractors before the Watres Act to $1.97 the present figure, although the cost per *mile* has decreased.

The answer is obviously more volume. Since the letter-envelope with perforated and gummed margin, single-fold, 8 in. square before folding, six to the ounce, will bring in $3.84 per pound as against $1.32 per pound for present air mail, why not offer the mailing public a reduced rate for this smaller letter at a greatly increased profit?

It follows that any increase whatever in volume from this source will reduce the air mail deficit. If this increase reached 40 per cent, it would eliminate the deficit, thereby permitting the Post Office to: (a) Increase the number of air mail routes. (b) Permit more frequent schedules. (c) Offer better service for mail, passengers and express. (d) Operate the air mail on a self-supporting basis.

Under these circumstances, do you not feel that this suggestion should be allowed a trial? If you do, please take it up with your Senators and Congressmen, the Committee on Post Offices and Post Roads and with the Post Office Department.

A. L. RUSHTON,
Omaha, Neb.

SERVICING SHORT CUTS

A crash truck with a gas fire fighting system

THE Navy has adopted a number of Lux crash trucks which are fitted with cylinders of CO_2 gas for extinguishing airplane and fuel fires. There are eight hand extinguishers and two 200-ft. hose reels, each of which is attached to a separate bank of four cylinders loaded horizontally behind the driver's seat. Large shielded nozzles with temporary shut-off valves are provided. The gas is applied simultaneously from both sides of a blaze in such a way as to produce a smothering blanket.

Mobile cranes for handling engines

HANDLING engines in and around maintenance shops is always a problem, and almost as many types of equipment are in use for this purpose as there are individual shops. The Army Air Corps has recently purchased from the Caterpillar Tractor Company a number of gasoline tractor units equipped with a specially designed Willamette Ersted gooseneck front boom. Suitable dead weight has been applied to the rear end of the tractor to counterbalance the weight of engines or other heavy material suspended from the boom.

A smaller device for the same purpose has been in satisfactory use for a long time at the Atlanta Depot of Eastern Air Transport, Inc. In this case both the hoisting, and the moving of the truck are by hand power. The hoist was built by the Manley Manufacturing Company, and has been fitted with auxiliary devices to adapt it to handling of radial air cooled engines.

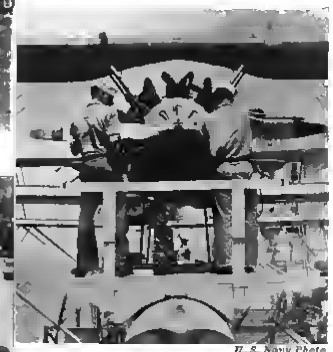
The construction of the Manley hoist and the methods of use are clearly indicated in the photograph reproduced at the left.

Aviation

Ship-board servicing of Navy planes

FOR getting at engines and propellers of the complement of observation planes on board the "U.S.S. Chicago" mechanics have devised a servicing platform which permits work being carried out while planes are mounted on deck cradles or on catapult carriages. The arrangement consists of a wooden platform designed to fit saddle-like over the forward deck of a seaplane pontoon. Rubber cushioning strips prevent damage to the deck. A removable wood and rope railing is provided for the safety of mechanics working on the platform.

Left: Handling Army engines with a Caterpillar tractor. Above: A smaller hoisting device built by the Manley Manufacturing Company, at E.A.T.



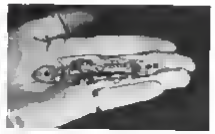
U. S. Navy Photo

Above: Servicing platform on the "U.S.S. Chicago." Left: Emergency truck adopted by the Navy, equipped for extinguishing gasoline fires.

THE BUYERS' LOG BOOK

Compact extensometer

A SMALL and ingenious extensometer which may be attached to almost any part of an airplane structure for measuring strains under flight conditions has been announced recently by the Baldwin-Southwark Corporation. The instrument weighs less than 1 oz and is about 4 in in over-all length. It may be attached to the member in which the strains are to be measured without drilling any holes in, or otherwise damaging the structure. Any relative movement of the two parts of the instrument is recorded on a small strip of polished steel against which rests a sharpened stylus. The instrument is arranged to record tension or compression strains and will also record shear when tension or compression strain is present. With slight modification, pure shear strain alone may be recorded. Once the strain is measured on material of a known modulus of elasticity it is a relatively simple matter to evaluate stress. A simultaneous study of conditions under any given loading in any structure may be made by placing a number of the extensometers at various critical points.—AVIATION, *October, 1932*



Baldwin-Southwark extensometer

Safety gasoline filler cap

THE use of screens for arresting fire, long used in the Davey safety miner's lamp and in the Bunsen burner, has been applied to Protectoseal products for the elimination of fire hazards connected with the transportation and transfer of inflammable liquids. The latest Protectoseal unit has been designed for the filler cap on airplane gasoline tanks. The device consists of a closed well, built up with two layers of perforated metal, suspended from a flange which is bolted to the tank proper and which carries a removable cap. A spring-loaded relief valve and a vent pipe are built into the screw cap. The valve will lift under 2½-lb per sq in pressure in the tank, which is well below the safe limit of 4 lb per sq in established by the Department of Commerce. It has been demonstrated that an open flame may be brought close to the filler opening over a full or partly full tank of gasoline without danger of an explosion. The entire device adds very little to the weight of the tank, and may be applied with little change in design. A flush type fitting is also available, which eliminates any flow of gasoline resulting from spillage between the walls of the tank and other parts of the airplane structure.—AVIATION, *October 1932*

Protectoseal filler cap

Airplane wrench set

THE Blackhawk Manufacturing Company of Milwaukee, Wis., is marketing a kit of socket wrenches designed for the use of airplane mechanics. The set includes three crowfoot wrenches with ½-in., ⅝-in. and ¾-in openings; three extensions, 3 in., 10 in., and 18 in long; and a selection of speeder handle, ratchet, hinged offset, and nine double hex sockets with openings from ¼ to ¾ in., and four box types with openings from ⅜ to ¾ in. The tools are finished in chromium plate and are put up in a steel case.—AVIATION, *October, 1932.*

Position light

A NEW type glass position light which meets the requirements of the Department of Commerce, has been introduced by Air Transport Equipment, Inc., of Roosevelt Field, Garden City, N. Y. Reflectors are so arranged that 15-cp. bulbs will meet the visibility requirement. The low power bulbs used effect some saving on batteries. Bulbs can be replaced quickly without tools. The lights can be installed in any position and will fit any standard base without additional plates. Each light weighs 7 oz complete.—AVIATION, *October, 1932.*

Aircraft tank gages

THE Liquidometer Corporation manufactures a remote reading fuel gage for aircraft, which gives a direct indication in the pilot's cockpit of the condition of all fuel tanks throughout the ship. Gages of this type are in use on a number of military and commercial aircraft, including an extensive installation on the dirigible "U.S.S. Akron." These gages are not limited to use with gasoline, but may be applied to any liquids ranging in viscosity from heavy printers' ink to liquids one half the weight of commercial gasoline.—AVIATION, *October, 1932.*

Midget drill

AN electrically driven hand tool has been added to the line of the United States Electrical Tool Company, Cincinnati, Ohio. Designed for light duty in close quarters, the ¼-in Midget Drill weighs about 3½ lb and is 8 in long (without the removable handle). The body is of aluminum and the gears are of the double-reduction type, operating in a grease-tight compartment. The drill is furnished with a ¼-in. screw back chuck. Ten feet of rubber-covered cable and a soft rubber attachment plug are standard equipment.—AVIATION, *October, 1932*

Moving picture camera

DESIGNED for exploration and aircraft work, a new 35 mm Eyemo moving picture camera has been placed on the market by Bell & Howell Company of Chicago, Ill. This model is designed to be motor driven, making remote control practical. Either a 12-volt or 110-volt motor can be adapted to the camera. The 12-volt motor is particularly suited for airplane work, as this type of current is available from the average airplane battery. The motor attachment may be easily removed for hand crank operation. The speed of exposure may be varied from 24 to 4 frames per second. Camera alone weighs 8½ lb., the motor drive weighs 3⅜ lb.—AVIATION, *October, 1932*

If you have not already done so—send now for your copy of

AIRCRAFT ENGINE LUBRICATION

It is one of the most interesting of recent publications on this important subject. • The July issue of The Texas Company's magazine "Lubrication," covering "The Relation of Lubrication to Aircraft Engine Operation"—fully illustrated by photographs and color plates, is an outstanding contribution. *Send now!* Fill out the coupon below. It's FREE. So long as copies remain in stock, they will be mailed to all who send in their request. THE TEXAS COMPANY, 135 East 42nd Street, N. Y. C.

TEXACO AIRPLANE ENGINE OILS
TEXACO AVIATION GASOLINE
TEXACO AERODIESEL FUEL
TEXACO MARFAK GREASES
TEXACO ASPHALT PRODUCTS
(for Runways, Hangar Floors, Aprons & Dust Laying)

PRESENTED
FREE
UPON REQUEST

COUPON

The Texas Company | 135 East 42nd St., N. Y. C.

We still have copies to take care of prompt requests, but in view of the demand, we suggest you write today—or use this coupon

Name_____

Address_____

WHEN YOU CAN'T TRUST THE WEATHER

YOU CAN TRUST THE AIRWHEEL*

THERE'S about half a year of tricky weather in the offing — weather that coats landing fields with a blanket of snow while your ship's in the air —weather that turns frozen fields into a sea of mud between sun-up and sun-down — weather that threatens forced landings because of low ceilings or sudden blizzards.

Play safe—with the only tire equipment soft enough to land safely on snow — and the only brake sure enough, smooth enough, strong enough to "stop on a dime" when you have to.

Get ready for winter with Airwheel equipment now.

Because it's soft, the Airwheel spreads out on muddy fields, plowed ground, sand or snow—and carries the weight of the plane safely over surfaces where planes with any other type of tire would sink down and nose over.

Cross wind and down wind landings are easier when your ship rides on Airwheels—and ground loops are almost impossible.

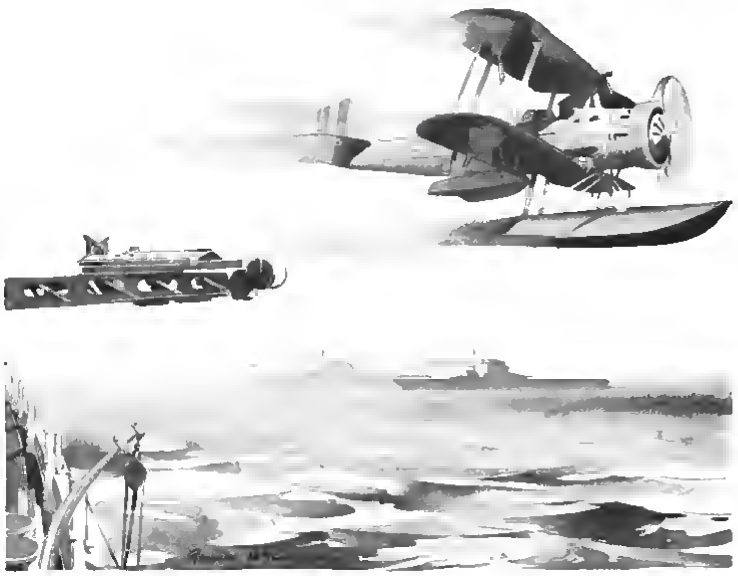
Don't expect balloon tires or semi-soft tires to give what you get from the genuine Airwheel—*only Goodyear can give you Airwheel safety.*

For engineering data, and full proof of what Airwheel equipment can do, write to Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

* IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL! AIRWHEEL *is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of* AIRWHEEL *tires.*

GOODYEAR

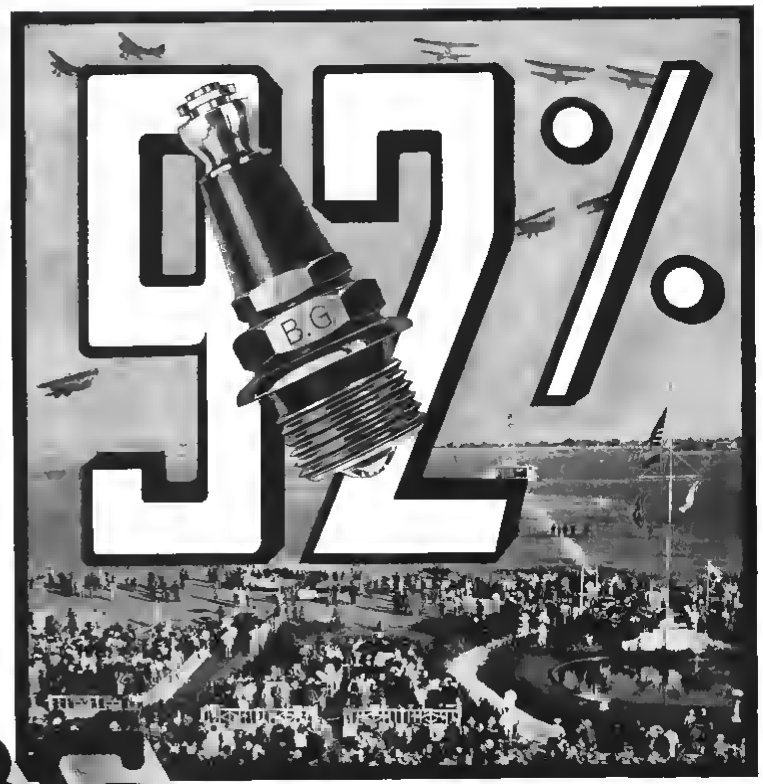
WHEN YOU BUY A NEW SHIP SPECIFY GOODYEAR AIRWHEELS



Out via Catapult ..In via Sling..and ready to go again..

To win the approval of the U. S. Navy for observation work with the Battle and Scouting Fleets, an airplane must have speed, climb and manuverability well beyond the severest requirements of commercial flying. Dependability and stamina are as basically necessary as engine and empennage. Flights that start on the catapult and end in the hoist sling are convincing tests of quality in design and structure. Because each of the series of new "Corsair" designs has passed all of these tests by generous margins, the Vought "Corsair" has long been the observation plane used on the Navy battleships and scout cruisers. Chance Vought Corporation, East Hartford, Connecticut. Subsidiary of United Aircraft & Transport Corporation. Sole Export Representative. United Aircraft Exports, Inc., 280 Park Avenue, New York, U. S. A.

CHANCE VOUGHT CORPORATION



BG

Of the 1162 aircraft engines on the field during the period of the 1932 National Air Races, 1068 (92%) were equipped with B. G. Mica Aviation Spark Plugs.

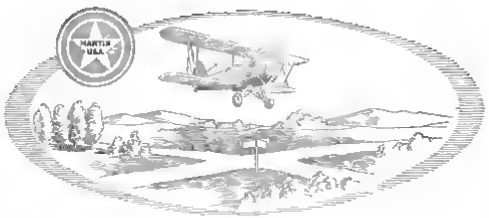
The winning planes in the Thompson Trophy, Bendix Trophy, the two Shell Speed Dashes, 1000 Cubic Inch Free-for-All, Aerol Trophy, the Derby Races and most of the other major and minor events had B G. equipped engines.

Thus, because of proved reliability and performance, B. G.'s were again the predominant choice of visiting and participating Pilots in this year's most important aircraft meet.

THE B. G. CORPORATION

Contractors to the United States Army and Navy and Aircraft Engine Builders

136 WEST 52nd STREET. NEW YORK **Cable Address, Golxteco, New York**



★ CROSSROADS ★

TODAY the airplane stands at a crossroads in the minds of many people. The alert business man and traveller has become very much interested in the future importance and usefulness of aerial transportation. The future importance and growth of aviation is only possible in complete manufacturing establishments, where thorough engineering and research are coordinated with scientific, straight-line manufacturing methods, bringing about more perfect aircraft as well as economies in first costs and operation. ★ Fortunately, the Martin Company foresaw this fact years ago, and put that foresight to practical application in the development of its organization and in the layout and equipment of its plant. As a result, it is our sincere conviction that nowhere else in the aircraft industry is modern manufacturing efficiency so highly developed; that nowhere else in the industry can aircraft of equal quality be produced at lower cost.

Glenn L. Martin

The Glenn L. Martin Company

Baltimore, Maryland, U. S. A.

BUILDERS OF DEPENDABLE AIRCRAFT SINCE 1909

15,265 Feet Free Fall—

stopped by pulling "IRVIN Rip Cord"

IN his barograph-attested record free fall of nearly three miles, H E Manning estimates his maximum earthward plunging velocity reached 250 miles per hour At this terrific speed, when within less than a thousand feet of the ground, he released the standard IRVIN Air Chute he carried—which functioned smoothly and perfectly

At the Cleveland Races, the delayed-opening parachute drops of "Spud" Manning thrilled the crowds by the calculating courage of the man and the sheer stamina of the IRVIN Air Chutes he used exclusively This year in the parachute contests "IRVIN" won 8 firsts out of ten 10 firsts in all! Insist on your Chute being an "IRVIN"—over 600 lives saved by it in emergencies

IRVING AIR CHUTE CO., Inc.

1670 JEFFERSON AVE., BUFFALO, N. Y.

1500 FLOWER ST., GLENDALE, CALIF. FT. ERIE, ONT., CANADA

10 hours, 19 minutes

—*Coast to Coast!*

JAMES HAIZLIP, as he alighted above from his record-breaking transcontinental flight from Los Angeles, at Floyd Bennett Field, New York

Instantly available, all the way, he carried comfortably form-fitting to his back, the confident protection of his IRVIN Air Chute In like manner in this new era of high speed flying, more pilots trust their lives to "IRVIN" than to all other parachutes combined

IRVIN AIR CHUTES

"The Life-Preserver of the Air"

The one great need of flying

The ability to return to earth in security at practically any time or place has been the one great need of flying. All other aircraft qualities are insignificant by comparison . . . The Autogiro can land safely in places that would mean disaster for an airplane . . . The Autogiro can either glide to a landing or settle almost vertically. With this option, there is practically no overland location where the Autogiro is not within reach of a suitable place upon which it can alight with security even if the engine quits

AUTOGIRO

AUTOGIRO COMPANY OF AMERICA . . PITCAIRN FIELD . . WILLOW GROVE, PA.

GUS and OLE . . . . the STANAVO boys

"I'm afraid, Gus, we will be 'stewed' before we know it"

All over the globe—even in countries where only the most adventurous of flyers are likely to land—Stanavo products may be found. They are used daily by the world's foremost aviators and commercial transport lines. In America, alone, more leading air lines are using Stanavo products than any other aviation gasoline or engine oil.

STANAVO

AVIATION GASOLINE AND ENGINE OIL

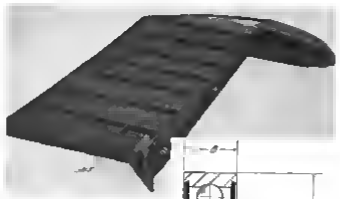
STANAVO SPECIFICATION BOARD, Inc. . 225 Bush St., San Francisco . 910 So. Michigan Ave., Chicago . 26 Broadway, New York City

"Most Deadly Weapon *of the* Army Air Corps" *uses 217 Fafnirs*

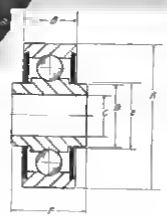
Speed with positive control and the utmost dependability are features of the new Curtiss Army YA-8 Ground Attack Plane made possible by the use of 217 Fafnir Aircraft Bearings in the control system.

Here is another instance where Fafnir Bearings have banished all friction and any danger of frozen controls and have reduced the possibility of costly repairs and replacements. Most of the Fafnir Aircraft Bearings used in the Curtiss YA-8 are the CP Type—Double Seal Single Row Bearings (see cross-section below) having seals of stainless steel with exposed surfaces cadmium plated.

The many practical benefits resulting from the use of anti-friction bearings in control systems of all types of ships have been largely due to the development of a wide range of Fafnir Aircraft Bearings including seal and cartridge designs. For valuable information concerning load ratings, dimensions and recommended uses, ask for the Fafnir Aircraft Data Sheets.



Skeleton of rudder assembly on the Curtiss YA-8



Cross-section of the Fafnir Aircraft CP Type Bearing used extensively in the Curtiss YA-8

THE FAFNIR BEARING COMPANY
New Britain, Conn.

Atlanta Chicago Cincinnati Cleveland Dallas Detroit
Los Angeles Milwaukee Newark New York Philadelphia

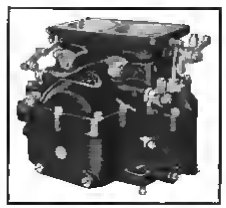
Fafnir·Ball·Bearings

PHOTO COURTESY OF U. S. NAVY DEPT.—BUREAU OF AERONAUTICS

"CLOSE HARMONY"
Stromberg dependability—Navy ingenuity

HERE'S the VF-5 squadron—one of the Navy's crack stunt trios in Section Vee formation. These boys can do more tricks with their Boeing Fighters than most of our actual feathered friends.

Exceptional maneuverability is highly essential in such planes; the carburetor is required to do its job in many positions—upside down flying, stunting, etc. The Stromberg does!



Stromberg NA-Y8C Carburetor double barrel type. Weight 15 pounds. Barrel diameter 2 15/16 inches. Capacity (approximate) 650 H. P.

And, as in the case of landing and taking off on the flying deck of aircraft carriers, formation flying requires the same steady operation and positive control of the engine that only Stromberg gives.

90% of all planes manufactured in the United States during 1931 were Stromberg-equipped. That's dependability! They must be good.

STROMBERG CARBURETORS

BENDIX STROMBERG CARBURETOR COMPANY

« SUBSIDIARY OF BENDIX AVIATION CORPORATION »

701 BENDIX DRIVE, SOUTH BEND, INDIANA

Share the results
of others' experience, experiments, practice

Nowadays, when men have to know more and do more, not only to get jobs, but to keep those they have, books are more than ever a necessary part of the technical man's equipment. He needs the quick route—through the other man's experience, as found in books—to refresh his knowledge of theory, master new subjects, improve his technique, get the quickest grasp on the newest and most important advances in his field. McGraw-Hill books are this kind of success tool—real job insurance. Why not plan to invest a few minutes a day in some of those listed below?

1. *Warner and Johnston's*—
AVIATION HANDBOOK . . $7.50

This book brings together under one cover a great volume of valuable reference detail for the aeronautical engineer, designer and draftsman. From many authoritative sources, some of them not otherwise generally available, have been gathered up to date and constantly useful information on the theory of heavier-than-air craft, materials and their properties, drawings and weight information on standard parts, installation data on engines and other large units, formulas, useful structural data, etc.

2. *Chatfield and Taylor*—
THE AIRPLANE AND ITS ENGINE—New Second Edition $3.00

Intended primarily for the reader who desires a sound knowledge of the basic principles and a broad view of the present development of the airplane and its power plant. No material is introduced which requires more than an elementary knowledge of physics or mathematics for its understanding. The discussion of the fundamental principles, construction and capabilities of the airplane and its engine are presented in simple form and adequately illustrated.

3. *Younger*—
AIRPLANE CONSTRUCTION and REPAIR $3.00

This book gives in convenient form fundamental material for complete training in the duties of an airplane mechanic. It presents problems and experiments for practical applications and for study of the basic concepts. The experiments are simple in character and may be performed with the ordinary equipment of the average shop.

4. *Weems*—
AIR NAVIGATION $5.00

In this textbook a special effort has been made to include the material necessary to round out the beginner into a practical air navigator. The book covers pilotage (or map reading), dead reckoning, and celestial or sun-line radio position finding, and celestial navigation. The discussion of celestial navigation includes a description of new efficient and novel methods and equipment not heretofore included in any text on air navigation.

5. *Reid*—
APPLIED WING THEORY $3.00

The first book in English to present a comprehensive treatment of the theory of aerodynamic induction wing profile theory and their applications, in a form which can be readily followed by engineers and students. The fundamental material is amply supported by experimental evidence and supplemented by helpful mechanical and electrical analogies.

6. *Maguire*—
AEROLOGY $2.50

This book presents a brief but accurate non-mathematical discussion of the atmosphere. Its purpose is to tell the aviator how the weatherman works, how to interpret the weather phenomena the pilot sees around him, and how best use may be made of the reports, advices and forecasts now made available.

7. *Holland*—
AVIATION $2.50

This book is planned as a textbook for airmen preparing for the Transport Pilot's Examination, and as a text and reference book in air piloting for the practical aviator. It covers air piloting, dead reckoning, radio navigation and astronomical navigation fully, and gives a complete outline of navigation procedure. The book was written with Department of Commerce requirements and United States Army and Navy practice kept in mind.

8. *Miller* — **THE AIRCRAFT MECHANICS' HANDBOOK $2.00**

This book covers all the data, information and methods that the mechanic needs in order to handle the work of airplane maintenance and repair in accordance with the highest standards. The book is written in easy, progressive and concise form and tells what tools are necessary and how to use them—describes the materials of airplane construction and how to handle them—gives methods for the repair of all parts of the aircraft and engine — describes inspection methods thoroughly, etc.

See the books FREE
Pay for them while you use them

Any of these books may be examined for 10 days free. Just fend the coupon indicating which books you want to examine. Pay for at return the books only after you have looked them over carefully. In addition, they may be paid for in easy monthly installments, provided that no payment is less than $3 and the total amount is paid in six months. There is no extra charge for this installment privilege, and the books may be examined before you pay one cent. Take advantage of this liberal offer.

Send this coupon now

McGRAW-HILL FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 330 W. 42d St., N. Y. C.

Send me the books checked below, postpaid, for 10 days' free examination. I will pay for or return the books within 10 days of receipt. I understand I may pay for them in monthly installments of $3 or more, sufficient to pay the total amount in six months. First payment to be made 10 days after receipt of books.

- ☐ Warner & Johnston—Aviation Handbook $7.50
- ☐ Chatfield & Taylor—Airplane and Its Engine, $3.00
- ☐ Younger—Airplane Construction and Repair $3.00
- ☐ Weems—Air Navigation $5.00
- ☐ Reid—Applied Wing Theory $3.00
- ☐ Maguire—Aerology $2.50
- ☐ Holland—Aviation, $2.50
- ☐ Miller—Aircraft Mechanics Handbook $2.00

Name

Address — Position

City and State — Company

AV-F-10

● Lack of a voltage regulator or improper adjustment will damage your batteries, and in the long run shorten their life considerably.

It's a simple matter to lengthen the life of your batteries and still keep maintenance costs low. The radio and landing-light equipment on every transport plane needs a 65 amp.-hour battery with a 50-amp. generator properly regulated. See to it that your planes have them. And that mechanics understand and keep a close check on this equipment. You'll find batteries will not need "pulling" for bench charge so often. You will save money.

But first give your ships a good battery—one that's especially built for aircraft service. The Exide Aircraft Battery is just such a battery. Light weight, compact, safe, dependable. Electrolyte will not spill. The performance of Exides over thousands of miles of sky lanes daily proves this is so. Investigate Exides today.

EXIDE ENGINEERING SERVICE—A corps of technically trained Exide engineers is located near each of the larger airports in the United States and welcomes the opportunity to cooperate with you and help solve difficulties you may now be having with aircraft batteries. There is no charge made for this service. Write us about it today. It is a step toward longer battery life and lower maintenance. It will save you money.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Exide AIRCRAFT BATTERIES

Contractors to U. S. Army and U. S. Navy

SEARCHLIGHT SECTION

EMPLOYMENT BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED—RATE PER WORD

Positions Wanted 10 cents a word, minimum $2.00 an insertion, payable in advance.
(*See ¶ on Box Numbers*)
Positions Vacant and all other classifications including equipment, 15 cents a word, minimum charge $3.00 an insertion.
Proposals, 40 cents a line an insertion.

INFORMATION

Box Numbers in care of our New York, Chicago and San Francisco offices count 10 words additional in undisplayed ads. Replies forwarded without extra charge.
Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

1 inch	$6.00
2 inches	5.75 an inch
4 inches	5.50 an inch

Other spaces and contract rates on request.
An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL THE 10TH FOR ISSUE OF FOLLOWING MONTH Aviation

POSITIONS WANTED

WANTS WORK. A & E man, six years' experience. Prefers work on private ships. Work for expenses. Reference. PW-100, Aviation, 520 No. Michigan Ave., Chicago, Ill.

YOUNG man 24. Parks Air College aviation and mechanic graduate would like job in East as mechanic's helper. Best of references. 8 years automobile and 1 year aeroplane work. J. W. Parsons, 14 Carlton St., Binghamton, New York.

SALESMAN AVAILABLE

SALES and advertising manager—If you're in need of a sales and advertising manager who is well known in the industrial field—thoroughly acquainted with modern selling and advertising methods, with market research and development backed by many years of successful experience in this kind of work for some of the country's outstanding industrial concerns—a man who can help you obtain that black ink position you are after—to secure full advantage of the present upturn. SA-148, Aviation, 330 West 42d St., New York City.

FOR SALE

AMERICAN Eagle Kinner 100 hp. Perfect throughout. Licensed to May 1933. Need cash, sacrifice $750. FS-162, Aviation, 330 West 42d St., New York City.

BUHL Bull Pup—Less than 100 hours. Located at Teterboro. Exceptional value at $450. Donald D. Cook, Teaneck, N. J.

BUHL PUP perfect condition, total time 68 hours, $750. Ideal ship for private flying. Harry Hermann, Bowles Airport, Agawam, Mass.

EAGLEROCK latest type Kinner powered, just relicensed. Special color. Plenty of extras, instruments, air wheel, etc. Best cash offer over $1,000. M. Becker, 68 Moeller Ave., Buffalo, N. Y.

Engineers, Mechanics

Tradesmen, salesmen, etc. Latest lists of new construction and active operations in U. S. and foreign countries present employment, sales and other possibilities. Trade pub. information. Stamped envelope for particulars.

INDUSTRIAL REFERENCE BUREAU
734 E. 83rd St., Chicago

BLIND FLIGHT IN THEORY AND PRACTICE

Normal Flight—Blind Flight—Radio—Landing
By MAJ. WM. C. OCKER & LT. CARL J. CRANE
America's Foremost Instructors
Clearly and Thoroughly Covers the Subject. 244 pages. 112 Illustrations. Price $3.00 Cloth Binding.
Order from Your Dealer or Write
Naylor Printing Co. — San Antonio, Texas

Pilots License Examination Made E-Z

Booklet of 300 typical exam questions with correct answers. Includes 1932 changes in Rules and Regulations. Aerodynamics, Engines, Ignition, Navigation and Meteorology. Covers all grade Pilot and Mechanic written exams. Send one dollar today. Booklet of Safety Flying Rules, 10c. Don't wait. Return on twenty flight maneuvers. Price 10c.

E-Z AVIATION SYSTEM
Box 6V, Rosedale, N. Y.

FOR SALE

EXCEPTIONAL opportunity — Diesel Bellanca special long distance ship, non-stop range 6,000 miles, ready for delivery. Bellanca Aircraft Corporation, New Castle, Delaware.

FOR SALE—D. H. Moth, Steel Fuselage, 440 Hours total time, engine just overhauled, air wheels, ship licensed to August 1933, and in excellent condition, price $750.00. Address J. W. Barton, Thompson Hangar, Cleveland, Ohio.

FOR SALE—Franklin Glider, newly licensed. Extra equipment consists of trailer, canvas cover, shock cord, tow rope, towing devices for automobile, single and two wheel landing gear, extra rudder and fin, and devices for airplane tow. The best offer over three hundred dollars will be accepted. Bevins Flyers, Phone Warwick 172, P. O. Box 67, Warwick, N. Y. Aeronca Dealers.

FOR SALE. New Fleets suitable 4,800 to 6,000 gross load at attractive price. Bellanca Aircraft Corporation, New Castle, Delaware.

FOR SALE. Licensed OXX6 American Eagle. Licensed until May 1933. Complete instruments in both cockpits. Twenty hours on motor since complete overhaul. $420.00 cash. L. Lightfoot, Gary, Ind. R. R. 1.

FAIRCHILD "22"

The most practical and economical airplane for student instruction.
With the "22," schools and clubs can make money even at today's low rates.
Let us make a convincing demonstration and discuss our liberal dealer franchise.

Fairchild Airplane Sales Corp.
270 West 38th St., New York

SEE THE WORLD while you LEARN AND EARN

Opportunity for man with $ — to invest to get his training for a transport license together with a wealth of flying experience such as no school can give at no cost while sharing the profits of a tour of the United States with a 3 — hour transport pilot doing special aviation work.

BO-161, Aviation
520 No. Michigan Ave., Chicago, Ill.

PARACHUTES
SOLD—SERVICED—RENTED
JOE CRANE
Roosevelt Field, Mineola, L. I., N. Y.

BARGAIN—Fairchild K R 32

N. C. 217 31 just relicensed, powered with Wright J-6. Both motor and ship in excellent shape. Privately owned. Always hangared and had best of care. Never cracked. $1500 cash including trying seat type chute in first class condition. Can be seen at Pine Brook Airport, Caldwell, N. J., or address owner.

A. E. SWETT, JR.
112 Sussex Ave., Newark, N. J.

FOR SALE

FOR SALE. Great Lakes, 200 hours, always hangared. Private flying. Perfect condition, new license. $1800.00 cash, no trade, in to need money. Harry Porter, 117 W. 8th St., Chattanooga, Tenn.

FOR SALE. J-5 Travel Air Speedwing in excellent condition. Never damaged. $1,500. Will consider trade for Warner Bird or Travel Air. Travel Air 2,000 tail assembly like new $50; upper and lower right wings, slightly damaged, each $60. Soo Skyways, Inc., Sioux Falls, S. D.

FOR SALE. J-6 Ryan, 6-place, A1 condition. Consider small ship in trade. L. E. Warburton, Elbow Lake, Minn.

FOR SALE or trade. 1 OX-5 Monarch biplane. Unlicensed in perfect condition. What have you? Lombard Airport Co. Inc., Lombard, Ill.

FOR SALE. Continental 165 hp. About 200 hours. Needs overhaul. Make offer. FS-163, Aviation, 330 West 42d St., New York City.

FOR SALE. New Gordon 17 Arrow fur-lined flying suit, 44, $40. Charles Hoffmeister, Imperial, Nebraska.

FOR SALE or trade for smaller plane, Stearman Biplane, licensed to September 1933. Aubrey King Flying Co., Malone, N. Y.

GREAT LAKES Trainer, privately owned. Excellent shape. 380 hours. Bargain for cash. Box 3812, Durham, N. C.

SZEKELY engines and parts. Five Cylinder Warner—new Continental A-40—new Bull Pup parts. Material and accessories 50% off market cost. List your requirements and send for quotations. Box 298, RR No. 2, St. Clair, Mich.

TWO PLACE cabin monoplane, exact copy of Bellanca Pacemaker two-thirds size. Warner motor, Pioneer instruments, Bendix brakes. Cruises 105. Wonderfully stable ship and motor like new. Bargain. Art Killips, Lyons, Ill.

WACO F relicensed, tip-top shape. Make offer. Need cash. Edward Becker, 250 Niagara Falls Blvd., Buffalo, N. Y.

WACO 9 excellent condition, covered new last year, engine good, quick sale $300. Eight OX-5 cylinders, $25. Laverne Whitlock, Davenport Center, New York.

WELLIE 60 hp, used 7 hours. Fuselage (cabin), wings, tail surfaces, complete. Lawrence 2 cylinder, used about 3 hours. Make me an offer. Chas. Hallas, Northville, Mich.

$875.00 Hisso Eaglerock, 163 hours, refinished. Cannot be told from new ship. NC to July, 1933. Frank Hoffman, 240 West Utica St., Buffalo, N. Y.

$750.00 A-4 Eaglerock, Hisso E. Bendix wheels, brakes, oil struts, tailwheel, licensed July 1932. $90.00 Hisso A motor. $120.00 Leblond 65 hp. All complete and overhauled. Harvey Vernon, Box 308, East Columbus, Ohio.

$300 cash buys OX Waco 10. Licensed to July 1933. Must be sold to settle estate. Refinished and like new condition throughout. Charles Hill, 844 Shirley Ave., Buffalo, N. Y.

WANTED

WANTED. Kinner C-5 210 hp. engine. Price must be right. Immediately. W-102, Aviation, 330 West 42d St., New York City.

WANTED. Velie Monocoupe. Prefer long wing. Must be licensed. Give complete description and best cash price. Robert H. Gray, Waseca, Minn.

There is a

Searchlight Section

in each of the following McGraw-Hill papers:

American Machinist
Aviation
Bus Transportation
Chemical and Metallurgical Engineering
Coal Age
Construction Methods
Electrical Merchandising
Electrical World
Electronics
Engineering News-Record
Engineering and Mining Journal
Factory and Industrial Management
Food Industries
Maintenance Engineering
Management Methods
Metal and Mineral Markets
Power
Product Engineering
Radio Retailing
Textile World
Transit Journal

For advertising rates and other information on any or all of these publications, address

Departmental Advertising Staff
McGRAW HILL PUBLICATIONS

Airplane Propellers
SPECIAL

Prices for October and November
BUY AN EXTRA PROP.

OX5 with all metal spinner	$40
OX5 without spinner	40
OX5 with spinner for Bird Ship	30
Kinners Warners	35
Challengers Hissos-Whirlwinds	30
LeBlond 60, Gipsy 90, Warner-85, Szekely, Anzani	30 / 25
Cirrus, old production	20
LeBlond 60 old production with Spinner	30
LeBlond 60 old production, without Spinner	30
LeBlond 60, new production; Genet, Rover, Velie — with spinner $40, without spinner $35	

STONE PROPELLER COMPANY
"Supreme Propellers"
Wichita, Kansas

Standard Airplane
with J-5 motor, licensed, in wonderful condition, $1800 net
Standard Airplane
with J-6 Wright motor, licensed and in exceptional condition, $2000
Fleet
Kinner motor, about 50 hours since new, $1750
Fleet,
with Kinner motor in wonderful condition, $1000
Pitcairn Autogiro,
2 place, Kinner motor, in perfect condition, $3500

Telephone, write or wire

D. J. BARRETT, 231 East 101st St., New York City
JErome 7-7760

Get a radio operator's license

The new fourth edition of this well known book now covers all phases of Radio Operating including an authoritative section on aeronautical radio, based on government and aviation company examinations.

Just Published
RADIO OPERATING QUESTIONS AND ANSWERS
By Nilson and Hornung
FOURTH EDITION
350 pages, 5x8, illustrated, $2.50

Over 600 typical questions are answered in this new fully revised and enlarged edition. Covers all phases of radio operating—broadcasting, marine, aeronautical, police, amateur—and all types of licenses. Contains practically every question likely to be asked on an examination with full, proper answer. Illustrated where necessary.

E. L. Bibb, American Airways, Inc., collaborated in writing aeronautical radio section. Covers government and company requirements for pilots and radio positions in aviation.

Information on license examinations. Digest of radio laws and regulations. All information up-to-date and includes latest practices. Used and recommended by leading radio schools.

10 Days' Free Examination
Send this coupon

McGRAW HILL BOOK CO., INC.,
330 W. 42d St., N. Y. C.

Send me the new fourth edition Nilson and Hornung's Radio Operating Questions and Answers, postpaid, for 10 days free examination. I will send $2.50 or return the book within 10 days of receipt.

Name
Address
City and State
Position
Company FS.Av 10-32

DETROIT AERO MOTORS CO.
DETROIT—14019 Hamilton Ave.—MICHIGAN

WHEELS—TIRES—TUBE SETS
BRAND NEW

26x4 Complete set of two, clincher	$11.00
24x4 Complete set of two, drop center	[illegible]
26x4 Complete set of two, drop center	[illegible]
8x23 Complete set of two, drop center with brake assemblies	20.00
22x6 Complete set of two, drop center with brake assemblies	20.00

STANDARD STEEL PROPELLERS

2—Cirrus	$[illegible]
1—Kinner or Warner	110.00
1—Wright Whirlwind J-5	100.00
1—Wright Whirlwind J-6 165 H.P. each	120.00
1—Wright Whirlwind J-6 240 H.P.	150.00
1—Wasp	150.00
1—Wasp three-bladed like new	300.00
Wooden Propellers for Kinner & Warner	each $18.00

MOTORS FOR SALE

2—Wasp Model C like new each	$[illegible]
Continental 165 H.P.	[illegible]
Wright Whirlwind J-5 225 H.P.	[illegible]
Warner Scarab 110 H.P.	[illegible]
Velie 65 H.P.	100.00
Heath Henderson converted, brand new	75.00

MOTOR PARTS

Replacement parts for Wasp C & D, Wright J-5 & J-6, Warner—Kinner—Lycoming—Velie and other motors. Cylinder Heads—Oversize Pistons—Rings, etc.

REPOSSESSED

Stinson Jr. Lycoming. Licensed, like new, never cracked, leather upholstering, air wheels, townend ring, bank and turn, rate of climb, many other extras.

Fleet K5 Kinner powered, never cracked, like new condition.

These ships have been repossessed on account of non-payment and must be sold immediately to the highest bidder.

PAUL SNICK
Plymouth, Indiana

A New $15,000
FOKKER UNIVERSAL
for $9,000
A $40,000
FOKKER SUPER-UNIVERSAL
used only 100 hours for $9,000
KARL ORT, 660 W. Poplar St., York, Pa.

CURTISS MOTORS

Bargain prices. OXX6 $70. OX5 $50. Rebuilt like new. Will ship, inspection allowed.

GRANT MARINE MOTOR CO.
827 Whittier Blvd., Detroit, Mich.

Rebuilt Airplane Engines

Curtiss OX5, OXX6, Hisso A, E and I. Rebuilt Engines. Send for descriptive list. Parts for Curtiss OX5, OXX6, Hisso and all Air Cooled Engines. Send us your inquiries.

BECKMAN MACHINE WORKS
4020 West Lake St., Chicago, Illinois

FOR SALE

OX Travelair, 2000. Millerized, Scintilla Mag. Steel Prop. Semi air Wheels ... $585.00
Challenger Curtiss Robin. Motor recently overhauled and wings recovered ... $1485.00

Wings Corporation of Philadelphia
Wings Field, Blue Bell, Pa.

Specially Priced

TAIL WHEEL FOR TRAVEL AIR STEARMAN EAGLE ROCK

360° Swivel. Timken Bearing. Solid Rubber Tire. Easy Taxiing. Immediate Installation.

Air Transport Equipment, Inc.
Garden City, N. Y.

INDEX TO ADVERTISERS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Aviation* assumes no responsibility for errors or omissions.

DESERVING full confidence

...*Roebling Control Cord*

FROM start to finish, in the production of Roebling Aircraft Control Cord, painstaking thoroughness is enforced. Every detail of manufacture, every lot of material, is subjected to critical examination.

After the wire is drawn from steel of highest quality, rigid tests begin. Each one of the small wires for the cord must stand numerous gaugings, and bending and kinking tests. Then, after the wires are formed into a cord, the completed product goes through a series of severe bending, proof-loading and tensile strength tests.

A Roebling Cord must be as fine as Roebling, with all its resources and knowledge of wire, can make it. No effort is spared to make this cord deserving of the full confidence of plane builder and operator. We would welcome your request for complete information and samples.

Painstaking thoroughness also is applied to the making of all other Roebling Aircraft Products—Tinned Aircraft Wire; 19 Wire Aircraft Strand tinned and galvanized; Aircraft Cord (6 x 7, 7 x 7, 7 x 19) tinned and galvanized; Ferrules and Thimbles; Serving and Locking Wires; Control Strand and Casing, Electrical Power and Lighting Cables; Gas and Electric Welding Wire. We would be very glad indeed to receive your inquiry regarding these products and to supply samples

JOHN A. ROEBLING'S SONS CO., TRENTON, N. J.
Branches in Principal Cities *Export Dept., New York, N.Y.*

ROEBLING WIRE AIRCRAFT PRODUCTS

Vast Resources—High Craftsmanship—Far-sighted Vision—BENDIX

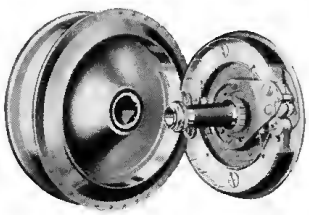
Nabady deliberately and knowingly buys inferiar equipment for aircraft, where quality and fine performonce are so necessary—yet there's no argument that certoin products ore *better* than others.

In the face of unrelenting pressure to reduce quality, Bendix believes thot Aviotion is best served by building every product as neorly perfect as passible; aiming ot superlotive performance.

Bendix Wheels and Brakes for airplanes and the new Bendix Pneudraulic Shock Strut are examples af haw vast resaurces, high spirit of craftsmanship, and far-sighted visian may oll be inspired by a single idea—a determination to produce "the best."

And typicolly Bendix is the development of special and exclusive mochinery used in their manufacture; contributing to superior quality and lower costs.

The services of Bendix' corps of competent engineers are always avoiloble for consultotion.



The pioneer product of their kind, ond stonding todoy os olwoys for preeminence in quolity, Bendix roller bearing Wheels ore the standord type for military ond civilion planes. Permanently improved broking, exoct concentricity of broke ond drum, reduced take-off run, ease of toxi-ing ond improved ground handling are obvious advontages.

RIM SQUEEZER—Typicol of Bendix' endless efforts to improve eoch product, to cut each manufocturing cost item, is this specially designed rim squeezer, performing the final operation, to exact form and size. Permits closest toleronces ond insures exoct profiles. Sizes mony other cylindrical members to greater exoctness thon is possible in ony other woy.

Another Bendix contribution to comfort ond sofety—the Bendix Pneudroulic Shock Strut. Impoct loods obsorbed by oil flow ond oir compression obove the oil; toxi-ing loods by oir compression. Rebounds definitely controlled by snubber.

BENDIX BRAKE COMPANY • South Bend, Indiana

(SUBSIDIARY OF BENDIX AVIATION CORPORATION)